RHODES UNIVERSITY

An Investigation of ICT Project Management Techniques for Sustainable ICT Projects in Rural Development

A thesis submitted in fulfilment of the requirements for the degree of

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By

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Abstract

Poverty alleviation by means of rural development has become a priority among developing countries. In turn, rural development may be significantly enhanced and supported by Information and Communication Technologies (ICTs), the use of which is highlighted by the emerging importance of information and knowledge as key strategic resources for social and economic development. An analysis of rural case studies where ICTs have been introduced, suggests that there are a number of barriers and constraints that are faced when taking advantage of these technologies. These include access to infrastructure, limited formal education, insufficient training and capacity building, financial and political constraints, and social and cultural challenges. These challenges threaten the success and sustainability of rural ICT projects. Sustainability is key to the effectiveness of a rural ICT project; therefore it is important to understand the concept and categories associated with ICT project sustainability in rural areas. The categories of sustainability which include social and cultural, institutional, economic, political, and technological, reveal critical success factors that need to be considered in the implementation and management of rural ICT projects.

The project management discipline acknowledges the importance of understanding the project's environment, particularly environmental factors associated with rural communities. The complexity of the environment therefore implies the need for a project to be undertaken in phases comprising the project life cycle. Project management practice for rural ICT project sustainability can therefore be examined, adapting the traditional project life cycle to a rural ICT project. A Rural ICT Project Life Cycle (RICT-PLC) that is sensitive to the critical success factors of sustainability is therefore proposed. In order to further investigate the phases of the life cycle of a rural ICT project, two case study investigations are explored: the Dwesa ICT community project, and the Rhodes University Mathematics Education Project (RUMEP) (MathsNet). A multiple case study analysis confirms the practices associated with the RICT-PLC model, and identifies additional characteristics, phases and practices associated with rural ICT projects. Finally, an enhanced RICT-PLC model is developed, that sets sustainability guidelines for ICT project management in rural areas and identifies the people, environments, technologies, systems, and requirements for ICTs to support rural development activities.

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** Photographed by Caroline Pade and researchers of the Dwesa ICT project team*

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I acknowledge that all references are accurately recorded and that, unless otherwise stated, all work herein is my own.

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Publications

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Chapter 1

Research Introduction

Chapter One introduces the research study. The research context is described to provide background for the research. The goals of the research, and the research methodology adopted are presented. Finally, a summary of the results of the thesis is presented.

1.1 Introduction

Information Communication Technologies (ICTs) play a significant role in social and economic development in developing countries, where interconnectivities and information flows can be established between rural communities and more developed regions (Heeks, 1999: 3). Rural development can therefore leverage off ICTs as supportive tools in the development process. Nevertheless, even though ICTs are beneficial for rural development, their implementation and sustainability in rural regions are limited (Accascina, 2000). Appropriate mechanisms and initiatives for the management and implementation of ICT projects in rural areas need to be developed.

This chapter provides an introduction to the research investigation. To set the background for the research study, the research context is explored. The goals of the research and research methodology adopted are then presented. A discussion of the summary of results then follows, and finally the thesis organisation is outlined.

1.2 Research Context

Developing countries have increasingly become aware of the need for development in rural areas where the majority of the population live. The rural population constitutes those who often lack access to basic needs such as food, water, education, health care, sanitation and security, hence leading to low life expectancy and high infant mortality rates (Munyua: 2000). Not unexpectedly, rural development has become a key challenge and priority among developing countries that have targeted the need for equipping the rural population to contribute effectively toward social and economic development. In this sense, rural development plays a role in assisting rural people to set priorities in their own communities through effective and democratic bodies, by providing local capacity, investment in basic infrastructure and social services, equity and security; hence dealing with the injustices of the past and ensuring the safety and security of the population, particularly that of women (NetTel, 2005: 59).

Information and knowledge have become fundamental to the rural development process, given the rapid growth in the information and knowledge society associated with the current wave of globalisation (Canadian International Development Agency (CIDA), 2003: 1). This emerging society has resulted in knowledge becoming a basic resource for economic and social development activities (Sunden and Wicander, 2003: 22). Communication is a key aspect associated with this kind of society, and has become an effective tool in supporting rural

development activities in developing countries. Information and Communication Technologies (ICTs) can be instrumental in rural development as they connect and facilitate information flows between rural communities and more developed regions. ICTs are generally defined as tools that aid communication between people through electronic means by capturing, processing, storing, and communicating information (Heeks, 1999: 3). ICTs consist of hardware and software, network appliances, radio, television, cellular phones, satellite systems *etc.*, as well as the services and applications associated with, for example, web conferencing and e-learning (The United States Agency for International Development (USAID) Group, 2003: 3).

Using ICTs for rural development can influence rural communities by supporting the management of knowledge and by becoming instrumental in networking and decision making, economic empowerment, and entrepreneurial activities. However, Hafkin and Odame (2002: 12) suggest that rural communities are faced with barriers and constraints in their use of ICTs, for example, lack of access to infrastructure, social and cultural influences, illiteracy and language, education and skills, and financial constraints. Information and knowledge that are transferred through ICTs have become important factors associated with the international, institutional and the political process of social and economic development. A lack of these sources of information has resulted in the Digital Divide that hinders economic growth, wealth distribution and social empowerment (CIDA, 2003: 2). The Digital Divide can be described as (The Association for Progressive Communications (APC) Organisation: 2004):

> *"the increasing gap between those who have and those who do not have access to information and communication technologies, access to content that benefits them socially and economically, skills to take advantage of ICT services, and the ability to afford to pay for digital services."*

The effects of the digital divide have forced local communities, government and international agencies to devise policies and initiatives to alleviate these barriers and support the implementation and sustainability of ICTs for rural development projects (Munyua: 2000).

Nevertheless, many unresolved issues persist in respect of an appropriate systematic approach on which to base the application and development of ICTs in African communities (Wanyeki: 2004). Benjamin (2004) suggests that the actual needs of rural communities must be assessed and analysed, so as to avoid wasting resources that result from a mismatch between what ICTs claim to provide and what is required for rural development. Indeed, in rural areas, ICT projects must be sustainable. According to NetTel (2005: 59), sustainability can be described as "development that meets the needs of the present generation without compromising the ability of

future generations to meet their own needs." Sustainability considers whether or not the technology is being put to use to support rural activities that benefit the rural population in a particular area such that the project may be replicated and maintained to influence other areas associated with rural development (International Development Research Centre (IDRC): 2005). Consequently, sustainability should be the focus of ICT project implementation, in which case, ICT project management techniques that are specifically designed for rural development need to be devised (CDA: 2005). Without this focus, most ICT projects in rural areas tend to fail as a result of poor project management (IDRC: 2005).

The Project Management Institute (PMI) (2000: 8) defines Project Management as the application of knowledge, skills, tools and techniques to project activities to meet project requirements. The application of an appropriate ICT project management approach in rural areas can be compared to the operation of a project in a broad organizational environment where project managers consider the greater organisational context (rural community). Schwalbe (2006: 41) encourages project managers to use a holistic systematic approach to understand how a project can relate to the organisation (rural community) at large. The adapted Three-Sphere model shown in Figure 1 illustrates this idea of systems management, which identifies key economic, technological, and rural society issues related to a project.

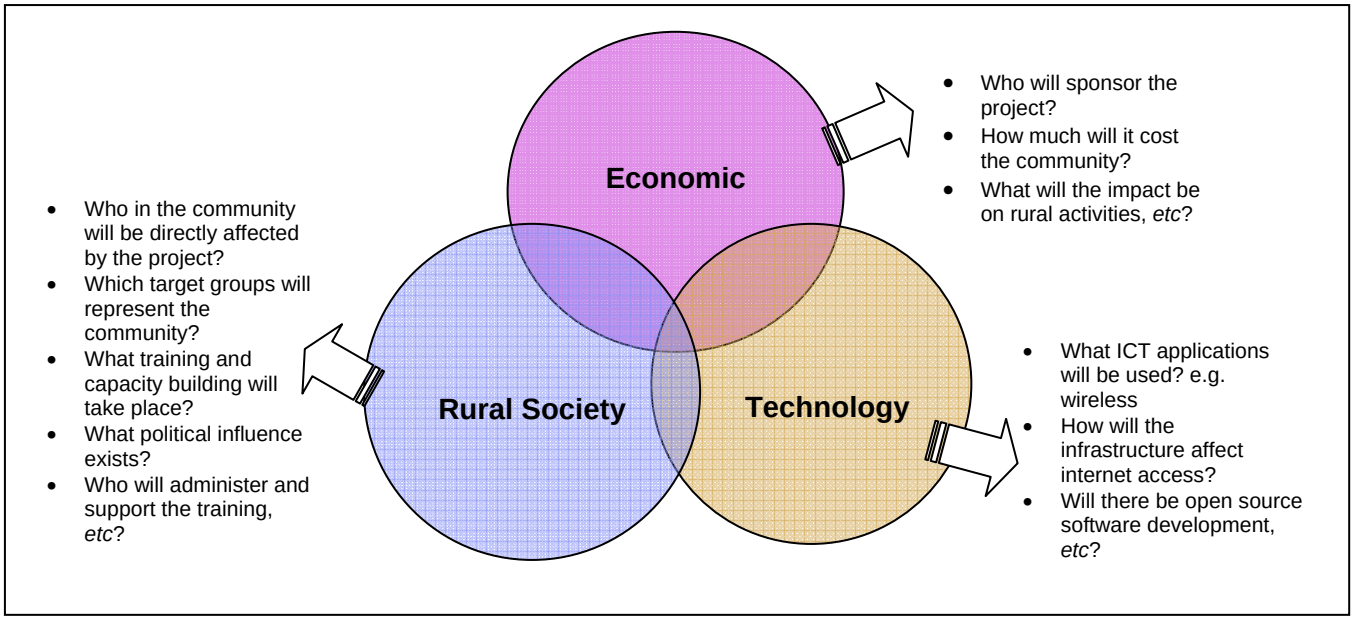

Figure 1: Three Sphere Model for Systems Management adapted from Schwalbe (2006: 42)

Instead of focusing unduly on the immediate and narrow concerns of an ICT project, Schwalbe's Three Sphere model can be used by project managers to keep in mind the specific interests and needs of the rural community in relation to the capability and sustainability of the technology.

ICT Project Management, suitably augmented, has the potential to promote ICT sustainability and the effective use of ICTs as an effective tool in rural development.

1.3 Goals of the Research

The goal of this research is to develop a guideline for ICT project management in rural areas that identifies the people, environments, technologies, systems and requirements for ICTs to support rural development activities effectively. These guidelines should be informed by the critical success factors associated with the implementation and sustainability of ICT projects in rural development.

1.4. Research Methodology

A qualitative research methodology based on case studies has been adopted. According to Myers (1997: 241), qualitative research involves the use of qualitative data, such as interviews, documents, and participant observation data, to understand and explain social phenomena. In this case, it uses qualifying words and description to record aspects about the world. Qualitative research therefore uses language as a sensitive and meaningful way of recording human experience in the field (Bless and Higson-Smith, 2000: 38).

The following procedure is employed:

a) A literature survey is performed on existing literature associated with ICTs, rural development and project management.
   - The general uses of ICTs for rural development are explored. The barriers and constraints associated with using ICTs in rural areas of developing countries are identified.
   - The dilemma associated with the sustainability of ICT projects in rural areas is investigated, identifying the need to focus on the "information need" of rural communities.
   - The concept of project management is explored. The link between ICT project sustainability and project management methodology or techniques is examined and applied to rural ICT project situations, so as to propose a guideline for ICT project management and sustainability in rural areas.

b) A multiple case study of current ICT projects in rural areas is investigated to observe their approaches to managing the implementation and sustainability of ICT projects. The ICT project management phases and practices adopted through each project's life cycle are explored. Chapter 5 describes in detail the case study research methodology used to collect and analyse data. The case study investigation is limited to the *South African*

rural context which is appropriate to apply this research. The case studies include:

- **The Dwesa ICT Project:** Dwesa is a rural community in the Eastern Cape. The Telkom Centres of Excellence at the University of Fort Hare and Rhodes University are currently involved in the development of an open source/standard e-commerce/telecommunication platform to deploy within rural and semi-rural areas in South Africa. The sheer size and political dynamics that are characteristic of Dwesa make it a community that represents a strategic emergent market for industry partners that support this ICT project. The project leaders are Prof. H. Muyingi and Prof. A. Terzoli, and the project team consists of Computer Science and Information Systems postgraduate students (Muyingi: 2004).
- **Rhodes University Mathematics Education Project (RUMEP) - MathsNet**: RUMEP works with teachers in rural areas to develop their professional skills and content knowledge. The aim is to improve the teaching and learning of Mathematics in rural schools of the Eastern Cape. Teachers work together in clusters, as agents of change and development in their communities. The MathsNet programme provides ICTs that are used to create teaching resources and access the Internet, and to store materials that are made available to other participants on the programme. ICTs act as a facilitator to link teachers who may share knowledge and resources (Sainsbury and Brown: 2005a).

The final result of the research study is a guideline for ICT project management application in rural areas which supports the implementation and sustainability of ICT projects.

1.5 Summary of Results

The key results of the thesis are summarised as follows:

- *Rural development is identified as a significant focus in developing countries towards reaching their goals of growth and poverty alleviation.* The availability of information and knowledge through ICTs improves effectiveness and efficiency of rural development projects.
- *ICTs aid in the communication of information and knowledge for rural development, and are therefore used for* entrepreneurial activity and market access, access to education and knowledge, addressing health challenges, rural empowerment and participation, addressing environmental sustainability, and establishing community networks
- *The challenges to ICT use identified* include infrastructure access, illiteracy, content, education levels, insufficient training and capacity building, financial constraints, political constraints, and social and cultural constraints.

- *The sustainability of a project forms a substantial part of the positive impact and success of ICT projects in rural communities*. Rural ICT projects can fail at different levels, where partial failure is particularly associated with projects that are unsustainable. Sustainability can be categorised into social and cultural, institutional, economic, political, and technological sustainability. Critical Success Factors (CSFs) exist to support each category.
- *An exploration of the concept of project management indicates that projects can be viewed as a series of inter-related phases* (project life cycle) that promote project sustainability in a complex rural environment. A proposed model developed to guide rural ICT projects is the Rural ICT Project Life Cycle (RICT-PLC), which incorporates the practices associated with the CSFs of sustainability, and the traditional phases through which the life of a project progresses.
- *A case study analysis* of the Dwesa ICT project and the RUMEP MathsNet project reveal specific additional characteristics and practices that need to be considered. These phases and practices include:
  - The Concept phase could be divided into two distinct phases, namely, Project Idea Generation and Project Feasibility with specific practices under each phase.
  - Additional practices were identified that may relate to specific CSFs of sustainability under the Development, and Implementation phases.
- *The final RICT-PLC model is summarised as follows:*
  a) A reflection of the research study on ICTs for rural development indicates that there are three key aspects that need to be considered in rural ICT projects:
     i. The project needs to be community-driven.
     ii. The project needs to be preceded by a pilot project.
     iii. The life cycle is iterative and incremental in nature.
  b) There are six phases that make up the RICT-PLC model: Project Idea Generation, Project Feasibility, Development, Implementation, Close-out, and Post Implementation Review.
  c) Two phases of the model are identified as iterative in nature: that is, Development and Implementation. The first iteration (iteration0), in particular, is associated with an experimental pilot project deployed in the rural community, and is followed by subsequent iterations that incrementally carry out the project.

1.6 Thesis Organisation

The thesis is organised into the following chapters:

Chapter 1: Research Introduction

This chapter introduces the research study. The research context is described to provide background for the research. The goals of the research, and the research methodology adopted are presented. Finally, a summary of the results of the thesis is presented.

Chapter 2: ICTs for Rural Development

This chapter explores a wide range of literature on the need for rural development in developing countries, and how ICTs can play a significant role in enhancing the development process. The challenges associated with the use of ICTs, which threaten the success and sustainability of a rural ICT project are also presented.

Chapter 3: ICT Project Sustainability in Rural Areas

The concept of sustainability is examined, and a trend in the factors that contribute toward ICT project sustainability in rural areas is identified. The categories of sustainability and the critical success factors that support these categories are investigated.

Chapter 4: Project Management Practice for Rural ICT Project Sustainability

Aspects of ICT project management practice are explored and a model to guide and promote the sustainability of a rural ICT project is proposed. The proposed RICT-PLC model which incorporates the practices associated with the CSFs of sustainability, and the traditional phases of a project life cycle is described.

Chapter 5: Case Study Research Methodology

The research methodology adopted to investigate existing rural ICT projects is described. The qualitative research methodology and case study design for the case study investigation are also described.

Chapter 6: Case Study Exploration of Current Rural ICT Projects

An interpretive case study of two rural ICT projects in terms of their project life cycle and practices, adapted in implementation and management to promote rural ICT project sustainability is undertaken. The two case studies are the Dwesa ICT Project, and the Rhodes

University Mathematics (RUMEP) ICT Project (MathsNet). The case studies are also analysed in terms of the proposed RICT-PLC model. A *detailed* description of each case study can be found in Appendix E.

Chapter 7: An Enhanced Model of the RICT-PLC for Sustainable Rural ICT Projects

This chapter revises the existing proposed RICT-PLC through the adoption of additional characteristics and practices identified in the case study analysis and research review.

Chapter 8: Conclusion

The overall research investigation is concluded. The contributions of the thesis are indicated and future research is identified.

Appendix A

A description of each Millennium Development Goal is provided.

Appendix B

This appendix details the aspects to consider in a business plan for an ICT project in a rural community.

Appendix C

This appendix shows the 44 project management activities, the process groups in which they are distinctively completed, and the knowledge areas in which they feature.

Appendix D

The interview schedule is presented, detailing the case study interview questions asked for data collection.

Appendix E

This appendix provides a detailed description of the Dwesa ICT project and RUMEP MathsNet project case studies.

Appendix F

A detailed profile of the schools and clinic surveyed in Dwesa, for the ICT project is described in Reports from Field Trip 1.

Chapter 2

ICTs for Rural Development

Chapter One provided background for the research study. This chapter explores a wide range of literature on the need for rural development in developing countries and investigates how ICTs can play a significant role in enhancing the development process. The challenges associated with the use of ICTs, which threaten the success and sustainability of a rural ICT project are also presented.

2.1 Introduction

Development is a key focus for developing countries, where rural development is crucial toward meeting economic and social goals. The growing information society has necessitated a reliance and need for information and knowledge, hence ICT, to support economic and social development activity. The potential of ICTs in the rural development process of developing countries needs to be understood in order to bring into context the requirement for mechanisms and techniques to promote ICT sustainability in rural areas. The aim of this chapter is to explore a wide range of literature on the need for rural development in developing countries and how ICTs can play a significant role in enhancing the development process.

A wide range of literature is explored to identify the need for development and poverty alleviation in developing countries, taking cognisance of the Millennium Development Goals that developing countries aim to reach. The need for rural development to address specifically poverty in developing countries is described and the importance of information in the rural development process is also explored. The chapter also defines ICTs and their application as tools for rural development with an outline of the uses of ICTs in rural development activities. Subsequently, the challenges associated with the use of ICTs in rural areas are considered.

The conclusion summarises the findings and identifies the need to understand and apply the concept of sustainability to ICT projects, so as to develop ways in which to alleviate the challenges associated with the use of ICTs in rural areas.

2.2 Development

A developing country has great potential to utilise its resources to promote social and economic development effectively within its economy. The focus of developing countries today has been on the need to realise this opportunity through taking action in promoting development within their countries. The aim of development is to contribute toward transforming the social and economic structure of nations by means of improving the population's lifestyle through improved education, skills development, income and employment (NetTel, 2005). The UNDP (2001a: 9) states that fundamental to the development process is recognising that people are the real wealth of nations. Development is consequently associated with expanding and building human capabilities, thereby creating an environment in which people can develop to their full potential and lead productive, creative lives in their communities, so as to meet their needs and interests. People are the beneficiaries of development, and the human capabilities they gain

enable them to become the agents of the progress and change that is brought about by development.

Developing countries are faced with challenges and setbacks in their effort to make development work effectively. Characteristics that are specifically associated with poor countries have made the development process difficult as they are struck with high levels of poverty and the associated challenges. Gerster and Zimmermann (2003: 21) describe poverty as being more than just material deprivation, also encompassing intangible aspects such as lack of access to schooling or health care, vulnerability towards external events or being excluded from decision making processes. Across the developing world, people, especially women, are still confronted with unacceptable levels of poverty and deprivation, as summarised in Table 1 (UNDP, 2004: 129). Of the 4.6 billion people living in developing countries, approximately 1.1 billion people live on less than $1 a day, more than 850 million are illiterate, 831 million are undernourished, nearly 325 million boys and girls are out of school, 11 million children under the age of five die each year from preventable causes – equivalent to more than 30,000 a day, about a billion lack access to improved water sources, and 2.7 billion lack access to basic sanitation.

Eliminating poverty: massive deprivation remains, 2000
(Millions)

Region	Living on less than $1 (PPP US$) a day	Total population under-nourished [a]	Primary age children not in school	Primary age girls not in school	Children under age five dying each year	People without access improved water sources	People without access to adequate sanitation
Sub-Saharan Africa	323	185	44	23	5	273	299
Arab States	8	34	7	4	1	42	51
East Asia and the Pacific	261	212	14	7	1	453	1,004
South Asia	432	312	32	21	4	225	944
Latin America and the Caribbean	56	53	2	1	0	72	121
Central & Eastern Europe & CIS	21	33	3	1	0	29	..
World	1,100	831	104	59	11	1,197	2,742

a. 1998–2000.
Source: World Bank 2003a, 2004f; UNESCO 2003; UN 2003.

Table 1: Eliminating Poverty (UNDP, 2004: 129)

McNamara (2003: 24) further describes poverty as not simply focusing on the lack of material and financial resources, but also considering the poverty flows that exist, that is, the transition of individuals and groups *into* and *out* of poverty. Some individuals and groups tend to remain in poverty and the reasons for this need to be understood. However, for those that flow into poverty, they are the product of economic decline, shocks and vulnerabilities that significantly

affect the poor. On the other hand, individuals and groups that flow out of poverty are the result of a combination of economic growth, opportunities for the poor, and mitigation of the risks and vulnerabilities particularly faced by the poor.

As highlighted above, poverty has become a significant issue with which developing countries need to deal. In order to escape the trap of poverty that hinders development, developing countries need to reach critical thresholds of health, education, infrastructure and governance that will enable them to achieve a kick-start toward sustained economic growth (UNDP, 2003: 18). Local governments have attempted to implement policies and initiatives toward development in their countries, but are faced with constraints and challenges beyond their control and budget. Participation of the world community, that is, international agencies, bilateral donors, private actors and civil society organisations, in the development process of developing countries is therefore essential if they are to reach their critical thresholds effectively.

The development community has continuously collaborated to devise policies and initiatives that can assist developing countries in their activities toward development. The Millennium Development Goals (MDGs) were formed as a result of UN resolutions and conferences attended by world leaders. In September 2000, 189 countries signed the UN Millennium Declaration committing their nations to stronger global efforts to reduce poverty, improve health and promote peace, human rights and environmental sustainability (UNDP, 2003: 15). The Millennium Development Goals that emerged from the Declaration are specific, measurable targets that have committed rich and poor nations to take action in reducing extreme poverty by 2015. According to Gerster and Zimmermann (2003: 19), the MDGs have created a vision that presents the opportunity to focus development outcomes and coordinate efforts among stakeholders. The MDGs have therefore become a common frame of reference used by organisations working in development. Table 2 displays the 8 Millennium Development Goals developed and Appendix A displays the associated targets of each goal that is aimed for 2015.

Some countries that have committed to reaching the MDGs have been considered as priority cases, as they are far from meeting their goals. It is therefore important for richer countries to collaborate and assist developing countries in effectively devising strategies to meet these goals within their countries (UNDP, 2003: 15).

Millennium Development Goals
Goal 1: Eradicate extreme poverty and hunger
Goal 2: Achieve universal primary education
Goal 3: Promote gender equality and empower women
Goal 4: Reduce child mortality
Goal 5: Improve maternal health
Goal 6: Combat HIV/AIDS, malaria and other diseases
Goal 7: Ensure environmental sustainability
Goal 8: Develop a global partnership for development

Table 2: Millennium Development Goals (UNDP, 2004: 135)

2.3 Rural Development

As the MDGs guide development, it is important to recognise that the poverty that exists in the world today is predominantly rural in developing countries. Three quarters of the world's poor, about 900 million people, live in rural areas where they depend on agriculture and other livelihood activities (Bage, 2004; Carney, 2000). Poverty is a key challenge for developing countries as the majority of the population live in rural areas.

In order to understand the need for poverty alleviation and development in rural areas, it is necessary to identify what a rural area is, who the rural poor are, and the challenges they are faced with as a result of poverty levels in their different environments. The Rural Development Task Team (RDT) and Department of Land Affairs (1997) of South Africa define a rural area as:

> *"Sparsely populated areas in which people farm or depend on natural resources, including the villages and small towns that are dispersed through these areas. In addition, they include the large settlements in the former homelands, created by the apartheid removals, which depend for their survival on migratory labour and remittances."*

The people that populate rural areas can be classified into five categories (The World Bank, 2003a: 6):

- The Landless without any crop land,
- Those with a low asset base or smallholders; farmers with up to 2 hectares of crop land,
- Pastoralists who are not settled in any specific area and derive most of their income from pastoral livestock
- Rural women, especially those that head their households, and
- Ethnic minorities and indigenous populations

The rural poor are faced with challenges in developing countries as they are influenced by factors that contribute to underdevelopment in rural areas. Mwabu and Thorbecke (2001: 6) identify these factors as low agricultural productivity, environmental degradation, unsustainable population growth, poor rural infrastructure, lack of access to markets and market information, low levels of investment in people, ethnic and tribal conflicts, the HIV/AIDS pandemic, inappropriate economic policies, adverse effects of globalization and high disease burdens. Additionally, rural development is also constrained by the neglect of rural non-farm sectors, urban bias in public and private investment, and unfavourable social and geographically located institutions.

People living in rural areas often lack access to basic needs such as food, water, education, health care, sanitation and security, hence living in poor conditions characterized by low life expectancy and high infant mortality rates (Munyua, 2000). The majority of the rural population consider these conditions to be harsh, and are hence forced to migrate to urban areas seeking better conditions and employment to fend for their families in rural areas. Urban areas may be more developed; however, the slums of developing countries still make it difficult for the poor to earn an income sufficient for a suitable standard of living.

Given the circumstances that the poor in developing countries face, it has been identified that poverty is mainly based on a rural phenomenon. Mwabu and Thorbecke (2001: 21) explain this phenomenon as an essential route to development, through focusing on rural based growth. Rural areas hold substantial human and natural potential to contribute effectively toward development, both of which must be harnessed. Rural development must be promoted as it equips the rural population to help themselves in improving their community and economic activities. With this in mind, rural development reflects upon meeting the MDGs as a country can focus on addressing the rural poor who are fundamental to accelerating the development process. NetTel (2005: 59) explains that rural development plays a role in assisting rural people to set priorities in their own communities through effective and democratic bodies, by providing local capacity, investment in basic infrastructure and social services, equity and security; hence dealing with the injustices of the past and ensuring safety and security of the population, particularly that of women.

The approach to rural development or rural based growth focuses on developing the main economic sectors that exist in rural areas. The focus of most development communities used to be on developing the agricultural sector upon which they consider rural people to be highly

dependent (Carney, 2000; Mwabu and Thorbecke, 2001: 21; The World Bank, 2003a: 41). Cleaver (1997) claims that poverty reduction in Africa specifically requires agricultural development as it contributes largely to gross domestic product (GDP). In addition, since in most developing countries the major industries are related to the agro industry, agricultural marketing and farm input supply, expanding the agricultural sector allows for more raw-material to market and process, and more inputs needed for farming, hence stimulating these sources of growth in the economy. The World Bank (2003a: 40) further stipulates that the agricultural sector employs about one-half of the labour force in developing countries, with the rural population taking up a high share. Also, with growth in the human population and the shifting of dietary patterns (for example, as a result of HIV/AIDS), demand for food and other agricultural products has also increased substantially. It is clear that agricultural growth in developing countries is very important, but development organisations also need to realise that there is great potential in developing other sectors in rural areas in order to promote sustainability in rural development.

Sustainable rural livelihood approaches built from lessons in the past and recent poverty assessments have shifted their focus of rural development away from specific sectors such as agriculture towards the complex livelihood strategies of poor rural people and the many different dimensions of rural poverty (Carney, 2000). It is believed that rural development should not only focus on the agricultural sector, but also on non-farm sectors as engines of growth in the economy. Non-farm sectors include other livelihood activities in rural areas such as social activities (education, health and sanitation facilities), exchange/enterprise activities (market centres); and non-market institutions (social networks and safety nets) (Mwabu and Thorbecke, 2001). Even though agriculture is the main source of income and employment in developing countries, it still depends critically on the performance of non-farm sectors; for example, providing finance for farm investment, an innovative workforce, and a market for farm produce. It is important to realise that these two sectors do not operate separately, as past rural development approaches used to assume (focusing on agriculture), but instead complement each other to instigate and accelerate rural development (Mwabu and Thorbecke, 2001: 36). McNamara (2003: 42) proposes that diversifying the rural economy can have positive spill-over effects through improving access to infrastructure, government, credit, and other products and services valuable to farmers, while still strengthening local demand of farm products. Furthermore, created job opportunities and resulting improvement in the quality of life can help reduce the endemic problem of rural-urban migration in developing countries. Consequently, the promotion of this complementary relationship and collaboration created through communication

between the two rural economic sectors signifies the importance of information and knowledge that needs to be transferred and exchanged in the rural development process.

2.4 The Importance of Information and Knowledge for Rural Development

Information and knowledge are important resources in the rural development process as the global economy has become associated with an information society. Information and knowledge have become key strategic resources for social and economic activities to operate effectively in countries (NetTel, 2005: 8). According to Nassimbeni (1998 in NetTel, 2005: 8) this information revolution is identified by:

- The importance of information and the creation of knowledge
- The prominence of the role of information technology in the production and dissemination of information
- The use of information networks for the distribution of information
- The radical changes in people's lives as a result of the increasing integration of information and communication technologies (ICTs) into all spheres of public and private lives
- The necessity for citizens to be trained in new skills to allow them to benefit from access to a massively expanding store of information

The information society introduces a reliance on information that provides new opportunities and risks in society, depending on who has the ability to harness and use information effectively. Furthermore, the impact of globalization and trade liberalisation that has coincided with the information revolution has created a climate of increased opportunities and impediments, where knowledge and capital has become the centre of success in developing countries (Chapman and Slaymaker, 2002: 17). However, McNamara (2003: 26) indicates that weak governmental capacity and the overwhelming array of domestic and international challenges posed by globalization in developing countries, lessen their ability to shape global trends, processes and practices that affect their economy and society. For example, it is difficult for developing countries to participate in negotiating international rules in areas ranging from trade and intellectual property to health and medicine, in ways that could be favourable to sustained growth. Information and knowledge need to be made more accessible as the openness of a country to innovation and knowledge liberates the full potential of their workforce to contribute toward economic activity (Chapman and Slaymaker, 2002: 4). In this sense, developing countries need to realise that while education and training focus on developing the cognitive

skills of the workforce, information can importantly give *content* to knowledge for sustainable development.

According to Meyer (2002: 93), the lack of information can impact negatively on the rural development process and some governments, developers and planners still do not acknowledge the value of information as a resource for rural development. Accascina (2000) broadly defines the challenge of poverty as being the deprivation of information needed to effectively participate in the 'wider' society, being local, national or at a global level. Therefore, the significance of information and knowledge should be recognised, so as to integrate them into development policies and initiatives.

Rural development activities are associated with social, political and macroeconomic activities such as education, health, agriculture, markets and strengthening civil society. Information and knowledge are needed to provide rural people with the ability to expand their choices through knowing what works best in their communities, hence contributing to development, competitiveness and productivity (CIDA, 2003; McNamara, 2003: 28). Information and knowledge in this sense may relate to financially viable markets and income generating activities, availability of government services, skills development programmes and the recognition and dissemination of indigenous knowledge possessed by the poor, especially that of women. Rural people have potential to contribute substantially toward achieving development goals, through harnessing knowledge (Chapman and Slaymaker, 2002: 4).

Nevertheless, developing countries face problems when it comes to accessing information which they may use as a tool in rural development activities. Chapman and Slaymaker (2002: 5) indicate that societies and struggling economies that are the focus of rural development still remain a long way from becoming fully integrated into the information and knowledge economy as the specific needs and constraints of rural areas still need to be addressed. This problem is approached from the perspective of the information users in rural communities as there is a need to assess the diversity of these users and their knowledge requirements (Chapman and Slaymaker, 2002: 5; Meyer, 2002: 94). This is important as the extent to which users in rural communities are able to handle information in accordance with their needs, determines the usefulness of information as a resource for rural development. McNamara (2003: 42) indicates that rural people tend to possess an abundant store of local knowledge such as, which crops work best in which fields, long-term agriculture trends, and indigenous farming strategies. Additionally, they have well-developed strategies for how to seek and share information locally,

for example, that which is mostly oral, and heavily dependent on social networks and trusted intermediaries. The power in information and knowledge lies in when and how it is effectively used and applied in rural communities, in accordance with their information requirements (Meyer, 2002: 94). Chapman and Slaymaker (2002: 6) illustrate in Figure 2, a typology of information uses/requirements for rural communities in developing countries to prioritise their livelihood activities and investment decisions more effectively.

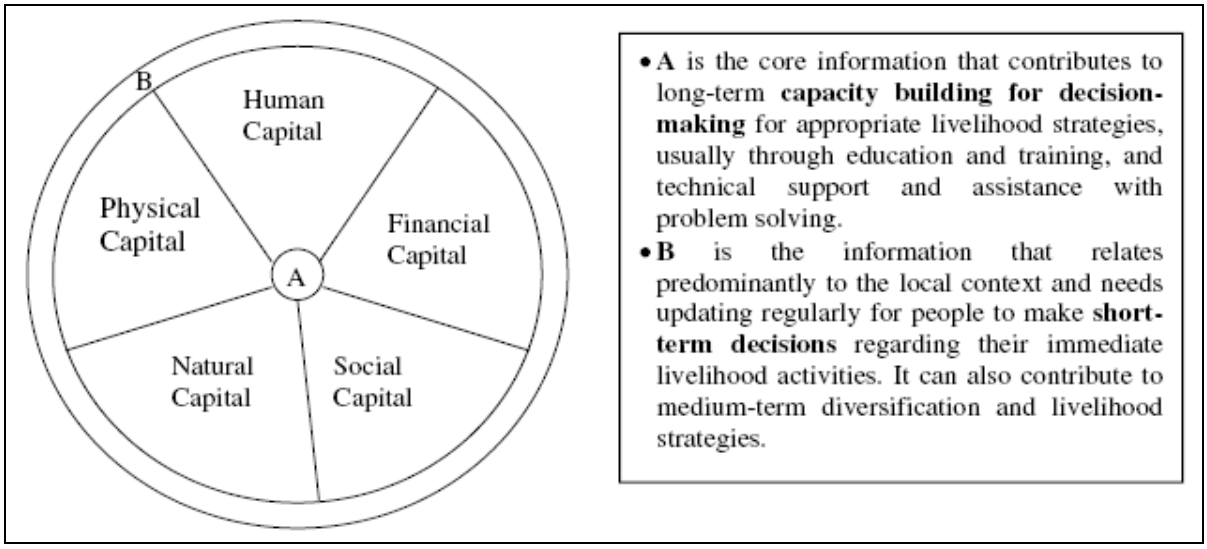

Figure 2: Livelihood Information Wheel (Chapman and Slaymaker, 2002: 6)

The categories of information in Figure 2, that is, Type A and Type B are not intended to represent two distinct types of information but instead illustrate the dual role that information can play in support of livelihood activities over time. Type A which represents the *core* information that contributes to long-term capacity building for decision making has been a key focus of agricultural extension, health, and education initiatives, and has extensively contributed toward enhancing knowledge in rural communities. In addition, it improves the understanding of systems and processes which may affect the way assets are used in the longer term and assists in the planning of rural livelihood strategies that can effectively insure against poverty stresses and shocks. For example, awareness about a community's rights and the structure and responsibility of public institutions that support them, enable them to hold these institutions responsible. Type B relates to information that assists in short-term decision-making used to capitalize on the potential of a particular asset at any one time, reduce vulnerability to shocks and respond to immediate needs, for example, information about markets and income-generating opportunities. (Chapman and Slaymaker, 2002: 6)

Communication is a key aspect associated with the information and knowledge society as information is continually transferred and exchanged between relevant parties. The power of information and knowledge in rural development can therefore be enhanced by Information

Communication Technologies (ICTs) which act as an effective tool in supporting rural development projects that have an impact on developing rural livelihood assets such as Human, Financial, Social, Natural, and Physical Capital (Figure 2) (Chapman, R and Slaymaker, 2002: 4).

2.5 Information Communication Technologies (ICTs) in Rural Development

Information Communication Technologies (ICTs) are effective tools in supporting the rural development process as they connect and facilitate information flows between rural communities and more developed regions. ICTs can generally be defined as tools that aid in communication between people through electronic means of capturing, processing, storing, and communicating information (Gerster and Zimmermann, 2003: 9; Heeks, 1999: 3; USAID, 2003: 3). They consist of hardware and software, network appliances, radio, television, cellular phones, satellite systems *etc*., as well as the services and applications associated with, for example, web conferencing and e-learning (USAID, 2003: 3). The five common characteristics associated with ICTs include (Gerster and Zimmermann, 2003: 9; UNDP, Accenture and Markle Foundation, 2001: 9):

- **Interactivity:** ICTs are effective technologies in allowing for two-way communication between different parties.
- **Permanent Availability:** ICT are available for use 24 hours a day, in that most information can be accessed anytime, especially using modern ICTs.
- **Declining Marginal costs**: The digital and virtual nature of ICT products and services subsequently allows for zero or declining marginal costs as the replication of content is virtually free regardless of the volume, and the marginal costs associated with distribution and communication are near to zero.
- **Pervasive and Cross-cutting:** ICTs are multifunctional and flexible as they can be applied to the full range of human activity for personal, business or government use, hence allowing for tailored solutions to meet diverse needs.
- **Global Reach:** With the creation and expansion of networks, geographical distance hardly matters, as ICTs provide individuals and groups with the ability to work anywhere, hence allowing local communities to become part of the global network economy.

ICTs are grouped into two categories, namely, ‘Traditional’ and ‘Modern’ ICTs. According to USAID (2003: 3), Traditional ICTs are those technologies that generally have been engrained into most people’s daily lives and consist of radio, television, fixed line telephones and facsimile

machines. On the other hand, Modern ICTs consist of computers and communication systems between computers, such as the Internet, database applications, wireless technologies (cellular phones, Personal Digital Assistant (PDAs)) *etc.* (IDRC, 2003: 11). The compatibility of these two types of technologies in rural communities of developing countries has often been a debate among researchers. Given the challenges that are faced by the rural population, such as education and illiteracy, it is assumed that traditional technologies are more suitable and tend to meet the needs of rural communities. McNamara (2003: 21) illustrates that the excitement and focus on high-end modern ICTs has tended to obscure the value of the radio as a development tool, which in many cases, is more appropriate, affordable, and adaptable to local community needs, than modern ICTs. However, the radio is limited in that it lacks the "many to many" interactivity of the Internet and tends to be a passive broadcast technology. Munyua (1998) also postulates that modern ICTs can offer multiple perspectives, such as faster and better focused access to information. The use of digital networks and telecommunications can also connect people and transfer information over vast distances, hence increasing the value of producing information, lowering the cost of delivery to audiences, and improving the capacity of rural communities to review the quality of services they receive (McNamara, 2003: 14; USAID, 2003: 4). Nevertheless, traditional and modern ICTs are not necessarily always used separately in supporting rural development projects, but can be used jointly, for example, using the Internet to search for information requested by radio listeners.

The widespread enthusiasm associated with the use of ICTs in rural development has consequently brought about the misconception in development communities that ICTs are the panacea for all rural development challenges (McNamara, 2003: 18; UN ICT Task Force, 2003: 5). In this sense, the focus has been on increasing the amount of ICTs in a rural area, without really considering the needs of rural communities, and their capabilities to harness and sustain these technologies. Sceptics such as Bill Gates and Cees Hamelink have challenged the potential of ICTs in developing countries, by stating that the poor do not need ICTs which are a luxury that people living on less that US$1 a day cannot afford (McNamara, 2003: 18; Sarakakis, 2004). However, in addressing this misconception, it is important to understand that ICTs are *tools* in rural development, and not necessarily the only solution to combating the challenges of poverty (Gerster and Zimmermann, 2003: 54; Mansell and Wehn, 1998: 15; McNamara, 2003: 19; The World Bank, 2003b: 8). They are meant to complement ongoing development projects and investments; hence ICTs do not *create* change, but instead *enable* change. The key to understanding the potential of ICTs is to begin an analysis, not considering the absence or presence of ICTs in rural areas, but instead identifying the challenges associated with persistent

poverty in a given community, the most effective measures in addressing these challenges, and only then the tools necessary to proceed (McNamara, 2003: 19). In this case, the tools may not only be ICTs, but also other resources, partnerships and development projects. Furthermore, McNamara (2003: 30) indicates that the impact of ICTs in a rural community depend on a complex set of resource endowments, human and institutional capacities, historical legacies and enabling environments. Addressing the deeper economic, social, resource and historical challenges faced by developing countries cannot be substituted by simply providing ICTs where they are not available, but instead identifying how ICTs can act as tools in enhancing development activities with a view to addressing those challenges. ICTs may consequently have the potential to enhance development activities in combating poverty, as an information, communication or knowledge component of virtually every development challenge can possibly be discerned (McNamara, 2003: 27).

2.6 The Uses of ICTs for Rural Development

The uses of ICTs as a tool in rural development can be applied in a variety of development projects and activities to promote sustainable rural livelihood approaches in alleviating poverty. Potential benefits and uses associated with ICTs as a tool in economic growth and poverty reduction tend to vary in scope and specifics across developing countries. In this case, ICTs in middle-income countries serve as a powerful engine for economic growth where interventions in specific sectors may lead to widespread poverty reduction, whereas in some of the poorest countries ICTs may only serve as a crucial tool in specific targeted interventions toward addressing key impediments in reaching the MDGs and breaking the cycle of persistant poverty (McNamara, 2003: 32). The following discussions describe the uses of ICTs as an enabler in rural development projects.

2.6.1 Entrepreneurial Activity and Market Access

Economic activity in rural development highlights the importance of market access and business development in rural areas. The livelihood of rural people in developing countries is greatly influenced by the opportunities available to participate in product markets, as the extent to which rural households can participate in agricultural, labour or credit markets determines their poverty rates (Mwabu and Thorbecke, 2001: 13). Furthermore, Mwabu and Thorbecke (2001: 13) and McNamara (2003: 15) indicate that rural poverty increases with distance to markets, therefore rural people need to be connected both nationally and globally in order to facilitate trade and hence connect to markets that offer new entrepreneurial opportunities. In this case, the *physical*

capital (Figure 2) of rural communities is increased, as markets are accessed, and in the longer term new markets, techniques, and processes for production can be explored.

ICTs act as key tools in economic market activity as they enable rural people to access market information and services. In order to make markets work for rural people, the development community has recognised the importance of information and communication associated with the operation and facilitation of trade nationally and globally. Chapman and Slaymaker (2002: 7) note that the value of market information in decision-making can significantly affect the sustainability, productivity and profitability of entrepreneurial activity in rural areas. Technologies such as wireless and web-based databases can therefore provide information on better prices, high level decisions on product movement, imports and exports, and qualities and quantities demanded, hence strengthening the forward linkage to markets (Mansell and Wehn, 1998; Munyua, 2000; USAID, 2003: 85). In Senegal, for example, the MANOBI project for fishermen provided up-to-date market price and weather information using Wireless Access Protocol (WAP) and short messaging service (sms) via cell phones (The World Bank, 2003c: 34). This has enabled Senegalese fishermen to secure higher prices for their fish directly, and more assured weather safety when fishing out at sea. Access to market information also enables rural entrepreneurs to plan effectively for the production and trade of their products. For example, the Food and Agricultural Organisation (FAO) launched a network called FARMNet in Chile and Mexico that provides essential market information to rural producers, associations, extension services and Non-Governmental Organisations (NGOs) (Munyua, 2000). Knowledge on the future prices of cereals and oilseeds has enabled farmers to better plan what quantities to plant over a certain period of time. In addition, reports on weather conditions faced by their competitors in other states and countries facilitated the planning of which markets to target in specific seasons for their vegetable produce.

As rural entrepreneurs have direct access to markets, this also reduces their dependency on middlemen, hence enabling them to have greater negotiating leverage through awareness of prevailing market prices for their products (McNamara, 2003: 27; IDRC, 2003: 28; The World Bank, 2003c: 7; Keniston, 2005). With less control from middlemen, this minimizes intermediation and allows rural entrepreneurs to have access to more reliable and fair market information. A project by PEOPLink developed a global artisan trading exchange system that provided local craftsmen with direct access to global markets; they now receive 95 percent of the selling price of their products compared to previously receiving 10 percent through intermediaries (UNDP *et al.*, 2001: 14).

ICTs can also act as a tool in setting the groundwork for entrepreneurial activity in rural areas, as they provide rural finance through Micro-credit/Micro-Finance initiatives (Sood, 2002: 29). Chapman and Slaymaker (2002: 8) and UNDP *et al* (2001: 13) indicate that *financial capital* (Figure 2) in rural areas can be improved as the support and strengthening of local financial institutions can provide improved information services and facilitate community-based savings and loan schemes. This will also improve transparency and more equitable service provision as financial information, for example, can highlight excessive rates of interest charged by money lenders. The Grameen Bank in India introduced a loaning scheme called Swayam Krishi Sangam (SKS) which provides micro-credit services to rural people (Counts, 2004). The scheme uses smart cards and hand-held computers for more efficient banking transactions that save time, reduce fraud and improve the buying power of India's poorest population. The availability of efficient credit markets can therefore facilitate more economic activity in rural areas.

2.6.2 Access to Education and Knowledge

Education is fundamental to growth in developing countries as the development of its dynamic labour force makes it capable of accessing and integrating knowledge into their economic and social livelihood activities, and effectively participating in the global economy (McNamara, 2003: 50; The World Bank, 2003b: 15). As the livelihood of rural people is improved, McNamara (2003: 50) points out that access to education and knowledge can address impediments and vulnerabilities that prevent rural people from seeking opportunities to improve their lives, and participate in more sectors in the economy that require greater skills and therefore offer higher income. The importance of education has been significantly emphasized in developing countries, where governments have attempted to devise policies to promote education. A focus in this aspect has been on meeting one of the MDGs, which is that of achieving universal primary education, in addition to devising initiatives that may enhance current education systems for secondary and tertiary education (McNamara, 2003: 51). Education and knowledge access improve the *human capital* (Figure 2) of rural areas as a skilled work force can participate more effectively in rural sectors that enhance growth and development (Chapman and Slaymaker, 2002: 8).

ICTs are effective tools for education that can be harnessed to improve the efficiency, accessibility, responsiveness, and quality of the education process in developing countries through E-learning (McNamara, 2003: 51; UNDP *et al.*, 2001: 12). Consequently, ICTs can be integrated in different areas associated with the education process, such as access to education

material that enhances classroom activity, teacher training, education administration, and possibly facilitating research in rural areas. UNDP *et al.* (2001: 12) state that in the case of primary and secondary education, ICTs have been found to enhance the learning process significantly by enabling access to knowledge and more collaborative and interactive learning techniques. Network technologies can potentially increase the availability of quality education materials as rural teachers are connected nationally and globally to educational institutions, which allows for customized sharing of knowledge, materials, and databases quickly and cheaply. Online resources can also support teachers and non-formal education facilitators, by offering a diverse range of educational materials that they could use in designing curricula that best meets the needs of their students (The World Bank, 2003b: 16; IDRC, 2003: 29). UNDP *et al.* (2001: 12) provides an example in Chile, where the *Enlaces* project provided 50 computers to primary schools, thus enabling teachers to improve the quality of the curriculum and allowed students to conduct collaborative projects with other schools around the country. Furthermore, video-conferencing and computer conferencing have already provided some learners in rural and remote regions of developing countries with access to teachers both locally and internationally (Mansell and Wehn, 1998: 88). The International Institute for Communication and Development (IICD) has also worked closely with SchoolNet Africa to establish an education network called Global Teenager that has been implemented in Ghana, Kenya and South Africa. The Internet and email are used to connect local and international learners and teachers, hence developing improved educational content, promoting cross-cultural understanding and raising ICT literacy and awareness among schools (IICD, 2005a).

A promising area in which ICTs can also help improve the quality and outcome of education is in teacher training (McNamara, 2003: 51). Education quality in rural areas of developing countries is low, as teachers are faced with inadequate resources for teacher training and curriculum development. McNamara (2003: 52) indicates that teacher training for rural schools has long been a priority in development communities, and ICTs, both traditional (radio, television) and modern (CD-ROMs, Internet), have been shown to have positive results in the communities they influence. ICTs can network teachers, nationally and globally, hence enabling them to share teaching strategies, lesson plans, and other experiences they have had in teaching (McNamara, 2003: 52). The World Bank (2003b: 15) suggests that ICTs are more relevant to the training of teachers than the training of students in elementary schools as it transfers knowledge to the person most likely to achieve effective dissemination in the classroom. The IICD (2005b) has supported this idea in an ICT teacher training project in Uganda, where the Ministry of Education has empowered teaching staff to mainstream ICTs in their professional

work, having been able to now train up to 8,500 teachers per year, compared to their project's first year of 3,500 per year.

ICTs can also improve the administration of education in rural areas by helping education bureaucracies become more efficient, effective and responsive through improved communication flows within them and between them and various constituencies, in addition to also increasing global access to knowledge and best practice in education (McNamara, 2003: 51; UNDP *et al.*, 2001: 13). ICT programmes can train school principals and administrators to use ICTs in improving the quality of administration activities through management software and computer networks. Other ICT software used can also enhance human resource management, cost-effective procurement of education material, student registration, and monitoring of student enrolment and achievement (The World Bank, 2003b: 16; UNDP *et al.*, 2001: 13)

McNamara (2003: 53) stipulates that in a knowledge-based economy, learning should not end with formal schooling, but instead the ability of working citizens to learn and adapt throughout the course of their productive lives should be promoted. ICTs such as the internet, digital videos and CD-ROMs can develop the skills of rural adults through distance learning and computer literacy training, especially among women and disabled people (The World Bank, 2003b: 15; UNDP *et al.*, 2001: 12). With this in place, rural communities can be effective in rural development as the adult population operates more efficiently in development activities while also being more capable in using ICTs as a tool.

2.6.3 Addressing Health Challenges

Rural people in developing countries who are subjected to high levels of poverty are more prone to disease and illness due to several related reasons. According to McNamara (2003: 54), the health challenges that rural communities are often faced with include unsafe and unsanitary living conditions, limited access to safe water and disposal facilities, poor diets that are low in calories and nutrients, and a variety of environmental hazards such as household smoke from cooking fuels and old stoves. Furthermore, wide spread and persistent diseases including malaria and tuberculosis have deepened "poverty traps" for individuals and communities; with the HIV/AIDS crisis taking a major toll, it has intensified the vicious cycle of disease and poverty, depriving households of their wage-earner, orphaning children, and depriving communities of a valuable workforce of teachers and professionals that could contribute significantly to development. The medical and social nets of developing countries are also weak, hampering the ability of rural communities to preserve good health and treat illness, as they are

compromised due to shortages in medical personnel, medicines and health infrastructure (McNamara, 2003: 54). Through the combined effort of the development community, they have devised MDGs that aim to address these health-related challenges, which include endeavours in reducing child mortality, improving maternal health and combating HIV/AIDS, malaria and other diseases (The World Bank, 2003b: 23).

ICTs can support projects in addressing rural health challenges in a variety of ways. Firstly, ICTs can assist in monitoring, responding to, and controlling the outbreak of diseases, hence addressing their causes through enhancing communication flows among, the knowledge available to, and the information-management capabilities of health professionals at local, regional and national level (McNamara, 2003: 55). ICTs facilitate data collection and analysis, as it allows for the integration of multiple databases which include laboratory reports and radiographic data (radiographic data refers to graphical and image based data, which allows for the storage, retrieval and transmission of medical images; hence the practice of Tele-radiology (Gester and Zimmerman, 2003: 30; Mansell and Wehn, 1998: 86)). In many cases of health-related emergencies, the time in responding to and collecting information about disease outbreaks, for example, can make a huge difference in how well a disease is treated and contained, due to faster communication flows between health professionals. The landlocked region of Tambacounda in Senegal is often affected by recurrent epidemics of flu, malaria and diarrhoea, hence the possible use of a computer warning system based on systematic data collection could significantly reduce both mother and child mortalities (IDRC, 2003: 30). In Sub-Saharan Africa, for example, the Internet is also used to monitor daily cases of meningitis and assist in coordinating mass vaccination programmes when threshold levels are reached (UNDP *et al.*, 2001: 11). ICTs can enable a country's health care system to improve significantly as health providers are able to assemble and share information about health trends, allowing the system to adapt more quickly and target resources efficiently (McNamara, 2003: 55).

ICTs also support activities aimed at the improvement of hygiene and other health-related behaviours in rural areas through disseminating what is known about the relationship between hygiene and health, and providing specific information about disease prevention strategies and behaviours, and epidemic response efforts (McNamara, 2003: 55; UNDP *et al.*, 2001: 11). McNamara (2003: 55) suggests that modern ICTs such as the Internet and mobile technology can enhance the ability to provide information whenever and wherever needed, combine and adapt it to the specific needs of communities, connect health professionals who may share their

experiences and concerns, and regularly provide public information on upgraded quality and relevance of health and hygiene based on global best practices. Gester and Zimmerman (2003: 30) give an example in Zambia, where ICTs have been used to help communities understand the role of antiretroviral drugs and also impacted on the Awareness, Behaviour and Change (the ABC of HIV/AIDS) of the youth who have had improved access to information. Furthermore, ICTs in Senegal have enabled youth and women to search for information related to HIV/AIDS confidently without any intermediary, avoiding social and cultural taboos surrounding matters associated with AIDS (IDRC, 2003: 46).

Rural areas are often limited in the number and capacity of health workers, particularly in remote isolated regions of developing countries. The use of ICTs can allow health professionals in rural areas to have access to relevant ongoing training programmes and the latest medical procedures, so as to act more decisively and effectively in achieving better results for their patients (McNamara, 2003: 55; The UNDP *et al*., 2001: 11; World Bank, 2003b: 23). According to UNDP *et al.* (2001: 11), several malarial Internet sites for health professionals have provided innovative 'teach and test' self-assessment modules to improve their effectiveness in treatment and diagnosis. Furthermore, ICTs enable health workers to have access to information from more highly trained medical professionals who have more knowledge and are specialized in treating certain medical conditions and disease (McNamara: 2003: 55). For example, in Bangladesh, physicians use the Internet via email to access the local MEDINET system that provides online medical journals which contain research on medical conditions, practices and diseases, for a mere US$1.50 per month (UNDP *et al*., 2001: 11; The World Bank, 2003b: 23).

Remote health workers who are few in number and limited in skills need at times to consult with specialists about medical conditions and diseases affecting their patients in rural areas. ICTs can therefore enable remote consultation, diagnosis and treatment without having to travel long, costly distances (McNamara, 2003: 55; The UNDP *et al.*, 2001: 11; World Bank, 2003b: 23). In The Gambia, for example, The World Bank (2003b: 23) reports that nurses use digital cameras and download images of symptoms on a personal computer (PC) that are then sent to doctors in nearby towns for examination. Using this same model, physicians can also send these images to specialists in the United Kingdom when expert advice is required, hence broadening the diagnosis and treatment available.

Lastly, ICTs can facilitate clinical administration through, for example, the streamlining of medical procurements and the storage of patient records in databases (UNDP *et al*., 2001: 11).

This has the ability to help rural clinics improve their effectiveness, quality of service and continuity (Mansell and Wehn, 1998: 85).

2.6.4 Rural Empowerment and Participation

Rural empowerment and the participation of rural people in economic, social and political matters facing developing countries are key to enhancing the rural development process. With vital decisions that need to be made in developing countries, government plays a significant role in devising policies and initiatives toward development. McNamara (2003: 57) indicates that governments have to design and implement a vast array of complex policies to promote economic growth, combat poverty, and also provide services to citizens according to their needs. Interaction between government, the private sector and civil society should therefore enable a participatory, equitable and gender balanced, transparent, efficient and accountable management of public affairs, which are prerequisites for sustainable poverty reduction (Gerster and Zimmermann, 2003: 22). However, developing countries are often constrained by weak institutions and mechanisms for public voice and participation in government, and the poor accountability of government institutions and officials, creating opportunities for inefficiency, corruption and the excessive influence of political individuals or groups in meeting their private interests (McNamara, 2003: 58). These kind of challenges facing both government and citizens have been perceived to have an information and communication dimension, hence the importance of ICTs in facilitating rural empowerment and participation (McNamara, 2003: 58). A variety of ICT applications play an important role in facilitating rural empowerment and participation such as traditional media (radio, newspaper), but McNamara (2003: 62) suggests that modern ICTs offer "more forms of horizontal, many-to-many communications on issues of public importance and give citizens more opportunities to organise around their interests and priorities".

According to Gerster and Zimmermann (2003: 27), ICTs enhance the transparency and accountability of government institutions and officials, through, for example, the dissemination of information for civic education on human and constitutional rights, laws and regulations and voting procedures. Rural people are empowered to monitor election processes and the provision of civil services according to development needs in rural areas. With this in mind, UNDP *et al.* (2001: 15) indicate that ICTs enable government to improve the quality and responsiveness of their services and also expand the reach and accessibility of services and public infrastructure through e-government applications that provide information over the Internet and other communication networks. For example, in the state of Madhya Pradesh, India, the government

introduced an intranet computer network for government services and local information. With faster and more transparent access to services, farmers can now get copies of land titles at 10 cents which previously used to cost US$100 from corrupt officials (UNDP *et al.*, 2001: 15). The promotion of transparency through ICTs plays an important role in alleviating corruption by increasing the costs of and decreasing opportunities for corruption. McNamara (2003:59) explains that ICTs automate and make procedures widely accessible, which traditionally were dependent on local government bureaucrats; for example, rural citizens now have direct access to forms, required legal documents, permits and certificates or the registration of a new small business.

ICTs also play a significant part in strengthening the public voice of rural people through providing information and mechanisms by which they can participate in the democratic process of their country. McNamara (2003: 63), The World Bank (2003b: 12) and UNDP *et al.* (2001: 15) explain that rural people often feel isolated, powerless and neglected; the use of ICTs could facilitate information exchange and joint action among rural communities through bringing their issues and needs to the national agenda. For example, the Gyandoot project in Dhar, India, developed a protocol in the form of *Shikayat* (complaint) which enables rural citizens to select from a menu of predetermined complaints for a fee of INR10 (for example, the absence of a school teacher, death of cattle that may require government veterinarian's inspection) (Sood, 2002: 63). This has put enormous pressure on local governmental offices, but has at least brought forward the poverty challenges and needs of the rural communities. ICTs can therefore also increase the participation of rural citizens in decision-making, implementation and monitoring of development policies and initiatives at local level. According to Chapman and Slaymaker (2002: 7), this is crucially important in the development process, as it enables people to defend their interests better and articulate their needs, and also increases their bargaining power to influence the decisions institutions make in relation to strategic rural livelihood options. Furthermore, the use of networks and electronic forums in civil society participation promotes richer and more diverse views on societal issues, empowers groups and individuals to address common concerns and interests which can strengthen governance and collective power, helps in multidirectional debate and the sharing of information among those with different perspectives, through mechanisms that are not directly linked to the political and governmental structure (McNamara, 2003: 63; UNDP *et al.*, 2001:16).

As civil society participation and empowerment increases, ICTs can also address social inequality especially in terms of gender issues. Women, who make up the majority of people

living in rural areas due to male rural-urban migration, tend to be excluded from participating in economic and political decisions that affect their own livelihoods. ICTs enable women to influence public opinion on gender equality, increase economic opportunities for women as they are educated on their rights and participate more effectively in decision-making (The World Bank, 2003b: 19). For example, the Food and Agricultural Organisation (FAO) launched a project in African countries called Dimitra which uses a website, databases and traditional media as tools to collect, disseminate and exchange information on the experience of grassroots organisations that work directly with rural women, so as to communicate internationally the voice of rural women for the development of policies and initiatives that affect their participation in rural agricultural development (Hafkin and Odame, 2002: 30) .

2.6.5 Addressing Environmental Sustainability

Sustainable environmental and natural resource management in developing countries contributes significantly toward sustainable growth in rural areas. According to McNamara (2003: 56), rural communities vitally depend on the environment and natural resource stocks, especially those that rely on agriculture for an income, therefore making rural people vulnerable to environmental shocks and long-term environmental constraints on growth. In addition, The World Bank (2003b: 27) points out that managing and protecting the environment can contribute to improving rural health conditions, sustaining primary production activities, and reducing the risks of natural disasters such as floods, mudslides and wildfires. As ensuring the sustainability of the environment is one of the Millennium Development Goals that needs to be reached, it is important to note that some of the most significant environmental pressures are rooted in poverty; for example, deforestation caused by the desperate need of the poor for fuel and agricultural land (McNamara, 2003: 57). Therefore, the application of effective measures and approaches to protect and manage the environment plays an important role in alleviating the effects of poverty, and also increasing the *natural capital* (Figure 2) of rural communities which could potentially promote tourism and economic growth in rural areas (Chapman and Slaymaker, 2002: 8).

Environmental sustainability for rural development can be facilitated by ICTs in a variety of ways. ICTs can be used to monitor environmental conditions and natural resource stocks. Remote sensing technologies and communication networks facilitate environmental data collection hence providing up-to-date information for real time simulation, analysis and decision support to speed up environmental monitoring and responsiveness, such as air and water quality monitoring and environmental emergency systems for forest fires and floods (Mansell and

Wehn, 1998: 88; McNamara, 2003: 56; The World Bank, 2003b: 27; UNDP *et al.*, 2001: 16). An increasingly powerful ICT application that is used in environmental monitoring is a Geographical Information System (GIS). A GIS can be used to design management plans and forecast environmental threats through automatic capture, storage, integration, manipulation, analysis, display and modelling of complex spatial data (Mansell and Wehn, 1998: 88; World Bank, 2003b: 27). For example, the Lake Victoria Environmental Project (LVEMP) of Kenya, Tanzania and Uganda uses a GIS to investigate the changes in wetland habits around the lake through satellite imaging (The World Bank, 2003b: 29). This helps to assess the wetlands quickly, identify and quantify threats (such as diseases and floods), propose solutions, and formulate guidelines for the lake's wetland management, hence benefiting the riparian communities.

ICT applications can also increase the awareness and knowledge of sustainable environmental approaches in rural areas through providing a medium for sharing information and good practices (McNamara, 2003: 56; UN ICT Task Force, 2003: 20). The World Bank (2003b: 27) indicates that this can improve people's understanding of environmental challenges, highlighting the need for environmental quality in an effort towards increasing economic growth in rural development. Information provided on good practice in, for example, agriculture and forestry, can lower pollution levels and reduce the consumption of energy, water and other essential natural resources in rural areas. For example, a GIS can facilitate weather and soil monitoring, and therefore crop forecasting to promote more efficient use of scarce resources in farming (The World Bank, 2003b: 17).

Communication between governments, business, scientific experts and concerned citizens is essential for the development and enforcement of policies and initiatives that affect the environment in developing countries. ICTs can enable public participation which promotes more inclusive and accountable policies and environmentally sustainable outcomes, through the monitoring of environmental abuses and the enforcement of environmental regulations (McNamara, 2003: 56; The World Bank, 2003b: 27). As a result, citizens who act as environmental enforcement agents can alert decision-makers of compliance infringements. UNDP *et al.* (2001: 17) gives an example where in Indonesia, officials concerned about the weak enforcement of water pollution standards created a public access database for the rating of factory compliance, where citizen groups used the ratings to put pressure on under-performing factories. This led to one-third of non-complying factories meeting regulations in the first 15 months.

2.6.6 Establishing Community Networks

Cultural heritage which encompasses social norms, values, attitudes and networks of society, is a key source for economic growth and development (Mwabu and Thorbecke, 2001: 13). It influences the way in which individuals in a given society understand their environment and the strategies they use to cope within their environments. Communities are encouraged to create community ties, thereby sharing solutions and approaches to contribute effectively toward rural development and increase their *social capital* (Figure 2) (Chapman and Slaymaker, 2002: 8; UNDP *et al.,* 2001: 13). ICTs can be used to establish social networks between local communities and the outside world hence facilitating discussion and exchange of information among different community organisations to enhance their knowledge on rural development approaches. A virtual community therefore emerges, where rural community organisations and institutions can develop active partnerships that collaborate in rural development strategies among their communities (IDRC, 2003: 32).

Through an emerging virtual community, ICTs (for example, email and VoIP such as Skype) also bring families and friends closer together by facilitating direct and instantaneous interaction over long distances (IDRC, 2003: 47). This can reduce travel costs and time spent travelling, as African communities depend on keeping close ties with relatives living in different communities, especially in the case of remittances from migrated family members.

2.7 The Challenges of ICT Use in Rural Areas

Rural development can be enhanced considerably by the use of ICTs in development activities. However, rural communities in developing countries are faced with barriers and constraints that limit their usage of ICTs to support their rural livelihood activities. These barriers and constraints are challenging in the planning, analysis, design and implementation of ICT projects in rural areas, which can eventually result in projects that are not sustainable or completely fail in a community. The ability of ICTs to support rural development is therefore limited as these constraints consequently promote the challenges associated with the digital divide which hinders economic growth, wealth distribution and social empowerment (CIDA, 2003: 2). The challenges faced by rural communities need to be understood so as to develop mechanisms that can address them, and hence support ICT project sustainability. The development community has been active in devising policies and initiatives to alleviate these challenges in developing countries as they have been acknowledged.

2.7.1 Infrastructure Access

Appropriate infrastructure is essential for ICTs to operate effectively in rural areas. According to Sood (2002: 19) the three basic infrastructural requirements for rural ICT initiatives include electricity, telephony and network connectivity. The problems associated with these three important inputs need to be tackled as they affect the implementation process of rural ICT projects in an integral way. Rural areas are constrained by factors associated with infrastructure access such as high infrastructure costs, limited private investment, and lacking or poorly developed infrastructure.

The high costs associated with ICT infrastructure in rural areas originate from the cost of building, maintaining, and operating ICT infrastructure. McNamara (2003: 69) indicates that the cost of building ICT infrastructure in rural areas is often prohibitively expensive or not commercially viable. According to the UNDP (2001b: 8) a combination of lower population densities, geographical distance, and high levels of poverty leave little commercial incentive for undertaking rural investment which is required to extend telecommunications and electrical infrastructure to power the technology. Greater investments in operating modern ICT infrastructure also include equipment (hardware and software), training, and maintenance of the infrastructure. Furthermore, ICT infrastructure in developing countries is unevenly developed in urban and rural areas, where urban areas provide more sustainable ICT investments than sparsely populated rural areas with costs per line being considerably higher (Chapman and Slaymaker, 2002: 26). This discourages private investment, as investors are not as optimistic on receiving a high return on their investment in rural areas, given the constraints they face.

Electricity and telecommunication infrastructure in rural areas of developing countries is also lacking or poorly developed (Munyua, 2000: 6). Sood (2002: 19) explains that in India's rural areas that have electricity, electricity may not last through the day, and at times may last between 6 and 8 hours. In addition, some areas where electricity is available, the voltage and frequency may vary outside the acceptable limits for ICT hardware to operate. Alternative forms of power are therefore being considered to power ICTs in rural areas. Warschauer (2003: 50) also postulates that the strongest factor correlating with Internet access is teledensity which tends to be lacking in rural areas. Satellite and wireless technologies are being used in developing countries for Internet access; conversely rural areas are often poorly serviced and inadequate in terms of low bandwidth, a weak Internet backbone, robustness, congestion, and noisy lines (McNamara, 2003: 69; Munyua, 2000: 6). Moreover, even though mobile telephony in developing countries has been expanding rapidly, and has proven useful to communities,

network providers often appear to be sceptical about roll-out in rural areas (Siochrú and Girard, 2005: 9). Although networks do reach some rural areas, Siochrú and Girard (2005: 9) postulate that, 'coverage does not necessarily mean access to poorer sections of the community'.

2.7.2 Illiteracy, Content and Education

Rural communities in developing countries are characterised by limited formal education, high illiteracy rates and a low proficiency level in English. Unfortunately, these factors determine the extent to which an individual may produce, acquire and interpret information through the use ICTs. According to the IDRC (2003: 70), research findings on ICT projects revealed that users of ICTs in rural areas tend to be those that can at least read and write, especially in English. In Ethiopia, for example, 98% of Internet users have a university degree, yet 65% of the population is illiterate (UNDP, 2001b: 9). Sadly, the uneducated and illiterate who make up the majority of the rural and working population in developing countries (for example, 70% of working population in Senegal is primarily rural), especially women, have been excluded from access to ICTs (IDRC, 2003: 70; Munyua, 2000: 6). Developing countries have attempted to develop ICTs that have a limited requirement for literacy, but these are only available in widely scattered projects, and usually most pictographic and audio-visual information has some text that goes with it (Hafkin and Odame, 2002: 13; Munyua, 2000: 6).

The rural population that are literate also face challenges in accessing information content from ICTs. Access to available ICT content is usually constrained by language, and its relevancy or applicability to the diverse cultures that dwell in rural areas. Warschauer (2003: 92) maintains that language is the most complex and significant issue relating to content and to broader issues of ICT and social inclusion. Accordingly, language affects how diverse groups can access and publish information, as well as the extent to which ICT serves as a medium for the expression of their cultural identities. Most ICT content, however, is available in English. For example, an estimated 60-80% of websites in the world are in English, while the rest are in one major 'Northern' language like Japanese, German, French, Spanish, Portuguese, and increasingly Chinese (Keniston and Kumar, 2003: 9; Munyua, 2000: 6; UNDP, 2001b: 9). A Village Earth Project and Consortium for Sustainable Development in India had attempted to connect rural villages through ICTs that provide appropriate information resources, but were constrained by most of their material being in English and not appropriate for every culture or region (Munyua, 2000: 6). Developing countries that have endeavoured to produce ICT content in their local languages still face problems as standard fonts for local languages are unavailable (Sood, 2002: 26).

The massive amount of ICT content that is being created and available today is often not relevant and responsive to rural user needs and local conditions. Heeks (1999: 8) indicates that important aspects of content (besides language) include 'source proximity' to understand the context of information, 'trust' of the information source for business decisions, 'knowledge' to access and assess information, and 'confidence' or 'security' to be motivated to take a risk in accessing and using information. Without the consideration of these aspects, problems of ICT project failure have arisen due to a project focusing on installing the technological system rather than understanding rural culture and the dynamics of existing information flows in a rural environment (UNDP, 2001b: 12). Technological aspects of ICTs can be highly intimidating for rural people; hence there is a need to make decisions on which ICTs are most appropriate for their contexts and needs (NetTel, 2005: 62; UNDP, 2001b: 3). According to Pigato (2001: 8), surveys of rural households illustrate that the poor favour and trust information sources close to home and those that are applicable to their existing knowledge base, yet the UNDP (2001b: 11) states that the systems and knowledge that arise in poor communities are often ignored. For example, Africa (excluding South Africa) generates only 0.02% of Internet content (UNDP, 2001b: 11).

Education plays a significant role in equipping people with the ability to understand, interpret and manipulate information accessed from ICTs, so as to limit the constraints associated with illiteracy and content. Norris (2002: 8) maintains that education improves the general capacity for analytical reasoning and information filtering, which assists in coping with the flow of information available online, as well as strengthening numeracy, literacy, English-language and keyboard skills. However, in some developing countries, rural people are deprived of the opportunity of a formal education, which limits their ability to use ICTs effectively.

2.7.3 Insufficient Training and Capacity Building

Training and capacity building should be central to the whole ICT project process. Meaningful community participation must be promoted in rural ICT development. Munyua (2000: 7) asserts that this paves the way for the creation of a critical mass of rural people who can effectively harness ICTs. A variety of traditional and modern ICTs can be used by people that have basic literacy or are illiterate, such as radio, television, telephones, and mobile phones. In contrast, other modern ICTs such as email, the Internet and databases require not only language literacy, but also technical and computer literacy to access and maintain these technologies (Pigato, 2001: 7). Table 3 illustrates the capacity levels required for the operation of contrasting user technologies.

	No Literacy	Basic Literacy	High Literacy/Language Skills	Computer Literacy	Technical Competence
Radio	*				
Television		*			
Telephone	*				
Mobile Telephone	*				
E-mail			*	*	*
Internet			*	*	*
Databases			*	*	*

Table 3: Capability Levels Required for Operation of Contrasting User Technologies (Adapted from Pigato (2001: 7))

Training and advisory services need to be provided in rural areas to different categories of users such as information intermediaries, telecentre staff, frontline workers, women's groups, and other community members (Munyua, 2000: 7). Users should therefore be trained on the operation and application of ICTs, as well as the development process of ICTs. Unfortunately, most developing countries lack the technical skills required for the efficient development of ICTs, as most technologies are imported and fast-changing. As a result, ICTs are developed to a large extent in the context, and for the cultural and social standards of developed countries, hence inappropriate ICTs for rural development are introduced due to limited *indigenous* technical skills (Davison, Vogel, Harris, and Jones, 2000 in IDRC, 2003: 72). Heeks (2002: 8) maintains that staffing and the local skills base in developing countries is limited in a wide range of skills for ICT development. These skills include systems analysis, design, and implementation, as well as a set of broader skills such as planning, implementation and the management of ICT initiatives.

The Acacia Project in Africa, sponsored by the IDRC introduced training as one of the first activities of the ICT project but was faced with significant problems which are typical of most ICT projects in developing countries (IDRC, 2003: 72):

- People trained were generally those directly involved in telecentre management, with less involvement of rural community members who lacked appropriate skills to use the ICTs
- Training in technical skills for managers of community access points tended to be confined to standard applications, with no technical training in the maintenance of ICTs

- People who act as intermediaries between the demand for and supply of information lacked the technical means by which to collect, process, store, transform and disseminate information in appropriate languages and channels for different end users
- Differences in training standards had made training difficult for communities in Senegal and South Africa, as attempts at translating training modules into local languages was not done in a systematic way
- The unavailability of training materials, especially the challenge of finding appropriate training formats and content for a variety of the needs of target communities and groups (women, youth, and entrepreneurs)

The above training and capacity building challenges and extreme short supply of skills and human resources in developing countries may be the greatest barrier for the diffusion of ICTs among rural people (Pigato, 2001: 7).

2.7.4 Financial Constraints

ICTs need to be affordable in order to be relevant and accessible to rural people. The implementation and use of ICTs in rural areas is obviously associated with costs that require sufficient financial resources that can support the sustainability of the project. Pigato (2001: 7) indicates that the financial resources needed, include those necessary for the supply of technical infrastructure (networks, hardware, software *etc.*) and those necessary to create demand for user technologies, information and communication services. The main providers of finance for ongoing ICT projects and services originate from heavy donor and/or government organisations who offer their services free to community members (for at least an initial period) (McNamara, 2003: 71). However, some services are private and solely dependent on income from users, who also generate income from using the ICT services provided. Pigato (2001: 8) explains that in the long term ICTs may be cheaper due to market liberalization and competition in economies, but in the short term, the inability of the rural poor to improve their standards of living in order to purchase and use ICTs acts as a major barrier. Access to ICTs in developing countries will therefore depend on the level of growth in the economy to raise consumer income and generate investment (public and private) in national networks.

Chapman and Slaymaker (2002: 21) and McNamara (2003: 71) identify that very few ICTs used in developing countries were developed with the consideration and analysis of the specific needs, priorities, ability to pay and market conditions of rural communities. Therefore, the new technologies are often too expensive for rural people, especially for an individual person who may live on less than US$1 a day. More flexible ICTs need to be developed for rural

development based on low unit and running costs. Accordingly, some rural people will therefore be prepared to pay for information that is relevant to them. However, Chapman and Slaymaker (2002: 32) still indicate that the *free* flow of information is critical to the efficient functioning of rural economic activity, hence inequitable access to ICTs among community members will need to be addressed.

Another financial challenge encountered in developing countries is associated with the high costs of Internet Service Provision. Even though several private Internet Service Providers (ISPs) have emerged due to market liberalisation, service provision is still through government who are often inadequate (low bandwidth and robustness), and rather expensive for local people (Munyua, 2000: 6). Furthermore, Warschauer (2003: 59) signifies that most ISPs are located in cities, hence rural people are faced with paying expensive long distance connection fees.

Cost-recovery is important to ensure the financial sustainability of ICT projects in rural areas, as insufficient financing can play a considerable role in project failure. It costs a great deal of money to pay for modern ICTs and the human resources necessary to run them, therefore cost recovery is imperative, which can render ICT services inaccessible to the rural poor who have to pay for the service (UNDP, 2001b: 9). The focus of most ICT projects has been the development of cost recovery mechanisms, but most have found it difficult to generate sufficient income to be financially self-sustainable. The World Bank (2003c: 84) explains that this was a result of projects relying on unproven business models (for community income generation), and some form of subsidised start-up funding or operational support. In addition, projects that provided "social goods", for example, at schools or within a national health service, found it difficult to establish feasible payment or income generation schemes. In this sense, ICT projects have a tendency to generate positive externalities which need to be carefully evaluated when considering the social return on donor investments (The World Bank, 2003c: 84).

2.7.5 Political Constraints

Rural community members are in some cases excluded from freely accessing ICTs due to political challenges influencing their power to take advantage of ICTs. Some developing countries have neglected to devise policies and initiatives that consider the challenges faced by rural people, usually because of political reasons. Munyua (2000: 6) postulates that the formulation and implementation of policies and initiatives in the ICT sector of most developing countries is still very rudimentary. In addition to this, policy review strategies and regulations in the telecommunications sector are lacking. Governments need to be active in the integration of a

set of laws, regulations and guidelines that shape the acquisition and utilisation of ICTs within their countries (Marcelle, 2000 in Munyua, 2000: 6).

A challenge most developing countries still face is the reformation of the telecommunications sector which is extremely important in facilitating ICT projects. Substantial progress still needs to be made in liberalizing the telecommunications sector, dismantling state monopolies, promoting private investment in infrastructure and service, reducing high tariffs and imports duties on ICT equipment, and increasing competition in all sectors of the telecommunications market (McNamara, 2003: 66; Munyua, 2000: 6). Developing countries, with liberalized telecommunication markets receive better infrastructure and services, together with positive spill-overs in other sectors of the economy. Furthermore, competition also encourages innovation, greater efficiency, and a wider and more rapid roll out of services. However, the "access for all" aspect of ICTs means that ICT initiatives and policies can be very political, as *state-controlled* information has always been a norm in developing countries (UNDP, 2001b: 6). In this case, even though the government is eager to cultivate ICT for economic aims, they are not confident about the free availability of information to citizens through ICTs as it may have destabilizing potential. The UNDP (2001b: 6) upholds that the effectiveness and potential of ICT initiatives is therefore affected by complex political positions that governments have concerning ICT growth and use, particularly in rural areas.

McNamara (2003: 67) indicates that an enabling environment for private sector growth is also crucial for a vibrant ICT economy in developing countries. Foreign direct investment needs to be attracted, but developing countries are still associated with fairly inhospitable environments for private sector growth and new business development. Private sector growth and new business development is often hampered by problems such as limited access to capital due to weak banking systems and financial markets, and the difficulty of securing business permits associated with improper discretion, favouritism, and corruption on the part of local officials.

The people usually responsible for political influence range from government officials to community leaders, elders and teachers. Consequently, political conditioning factors at many different levels affect the means in which the development community can promote ICT for development (UNDP, 2001b: 7). For example, *twenty-three* telecentres set up in rural Mexico in 1997, only had *two* remaining operational by 1999. The reasons for such project failure were political in nature for two reasons, in that (i) volatile political elections caused changes in important decision-makers and municipal authorities who were the real political (project)

"champions" of the ICT project, and (ii) the local elders did not support the telecentres as they saw them as a threat against their monopoly as knowledge brokers within the villages (they were not involved in project design and implementation) (UNDP, 2001b: 7). In addition, evaluators of a telecentre noted the following (Roman and Colle, 2001 in UNDP, 2001b: 7):

> *"We asked a school girl if her teacher encouraged her to use a computer for her school work. 'No,' said the girl, 'the teacher is afraid of the computer because we might learn something she doesn't know."*

Government and development communities therefore need to develop ICT policies and initiatives taking into consideration the influence of politics.

2.7.6 Social and Cultural Challenges

The use of ICTs in rural development has been restricted among certain people and groups due to social and cultural barriers within rural communities. According to the UNDP (2001b: 9), social and cultural barriers refer to:

> *"Factors that can cause individuals (or whole sectors of society) to "self-exclude" themselves from participation in ICT for development initiatives (thinking they are not intended for them)"*

Bridges (2006b) specifies that people are discriminated against, based on their race, gender, class, age, physical ability, HIV status, geographical location, sexual preference, religion and other social-cultural factors. Consequently, the trend has been that certain groups of people, such as women and youth, who play a crucial role in development cannot benefit from the support of ICTs in rural development activities.

Gender has become a significant area of discussion in ICT policy and initiative development in developing countries, where most of the Millennium Development Goals also focus primarily on increasing opportunities and reducing vulnerabilities faced by women (McNamara, 2003: 75). According to Munyua (2000: 7), men and women play different productive and community roles in rural development, and also have different needs and preferences. Women play complex and vital roles in economic and social development, with their wisdom and indigenous knowledge that is rooted in culture, traditions, value, and experience (IDRC, 2003: 68; McNamara, 2003: 75). An example of agriculture in rural development illustrates that women produce more than half the world's food, and in Sub-Saharan Africa, are twice involved in agriculture than men, make up 70% of agricultural workers, and produce 80% of the regions food (Munyua, 2000: 7; USAID, 2003: 19). However, women are often discriminated against in a male domineering environment, which is characteristic of most developing countries. The UNDP (2001b: 10)

indicates that the use of ICTs by women in development is not equal to their share in the world's population, where for example, a survey in African countries recognized that men dominated computer/Internet use, representing 86% of all users in Ethiopia, 83% in Senegal, and 64% in Zambia. The barriers and constraints usually faced by women that attempt to use ICTs in rural areas of developing countries include (Hafkin and Odame, 2002: 13; McNamara, 2003: 76; Munyua, 2000: 7; Pigato, 2001: 7)

- High levels of illiteracy among women in developing countries, especially in rural areas. An estimated two-thirds of the world's 876 illiterates are women, with half of all women in developing countries being illiterate.
- Lack of education and poor opportunities for women, as a result of gender bias in attitudes toward women studying or using technology
- Heavy workloads, demands within their households, and other multiple time-consuming economic and social roles discourage women from using ICTs due time constraints
- Poor access to finances, as women tend to have little control over family income, and no discretionary income of their own
- Some rural telecentres are located in areas that women cannot reach, especially in the evenings, when they have more free time
- Cultural practices and norms inhibit women from interacting with men and limit their ability to inquire about ICTs, as women are intimidated by men that tend to run such centres.

The above barriers and constraints that limit access to ICTs by women have implications on their attitudes and approaches to the use of ICTs. This is of particular concern since a lot of observers have noted that the involvement of women in the ICT development process is crucial (IDRC, 2003: 69).

Another social group in rural areas that is also discriminated against are the youth. Munyua (2000: 7) indicates that the youth make up a large part of the population in developing countries, for example about 50% in Kenya, yet they have been given little opportunity to participate in rural development. However, they have a propensity to contribute to development using ICTs, with their fresh and innovative ideas, as a survey done by the IDRC illustrates that most youth have expressed a need to have access to support structures for their cultural activities (IDRC, 2003: 30; Munyua, 2000: 7). Furthermore, the UNDP (2001b: 14) indicates that the youth are 'more inclined than adults to quickly and unselfconsciously explore, and appropriate new ICTs and their creative possibilities'.

The UNDP (2001b: 9) postulates that "Technophobia" has also acted as a socio-cultural barrier in discouraging the use of ICTs in some developing countries. For example, in Columbia, one of the subtle manifestations of power relations is associated with the use of certain kinds of equipment that is restricted to certain people and groups. This instilled a sense of fear among ICT project champions, as they were afraid of suffering feelings of inferiority, as a result of being asked questions they could not answer. Their insecurities resulted in them discouraging the local community from using the ICT services available.

The cultural chasm between oral (word of mouth, physical proximity of object, places and persons) and "virtual" (texts, files, windows, virtual reality) society, continues to be a challenge in developing countries, especially rural areas (UNDP, 2001b: 9). Moving from oral to virtual society has been difficult in most projects, which has made training a slow and complex process. As a result, ICTs have ended up not being used by the target community; nevertheless, students have still been attracted to the technology.

2.8 Conclusion

Rural development is a significant focus for developing countries toward reaching their goals in development and poverty alleviation. The availability of information and knowledge play an important role in supporting rural development activities, with ICTs able to promote the effectiveness and efficiency of rural development projects. However, rural communities are confronted with challenges that limit their ability to take advantage of the support of ICTs, hence resulting in ICT projects that either fail or are not sustainable. Sustainability needs to be understood and applied to rural ICT projects, so as to develop ways in which to alleviate the challenges associated with the use of ICTs in rural areas.

Chapter 3

ICT Project Sustainability in Rural Areas

Chapter Two explored ICTs in rural development. This chapter examines the concept of sustainability, and identifies a trend in the factors that contribute toward ICT project sustainability in rural areas. The categories of sustainability and the critical success factors that support these categories are investigated.

3.1 Introduction

Rural ICT projects are confronted with challenges relating to the implementation and eventually the use of ICTs, which subsequently results in projects that are not sustainable or fail. The sustainability of a project forms a substantial part of the positive impact and success of ICT projects in rural communities. The aim of this chapter is to examine the concept of sustainability, and identify a trend in the factors that contribute toward ICT project sustainability in rural areas.

To bring this research area into context, the notion of ICT project failure is explored, specifically identifying the different levels of project failure. The concept of sustainability and how it applies to ICT projects in rural areas is described. The different categories of ICT project sustainability are explored, and subsequently lessons learned and good practice from previous projects are investigated to reveal the critical success factors associated with rural ICT project sustainability. Finally, the conclusion summarises the findings and identifies the need to formulate an approach to ICT project management in rural areas that is sensitive to the rural requirements and critical factors that promote ICT project sustainability.

3.2 Understanding ICT Project Failure

ICT projects in rural areas can fail for a variety of reasons that are linked to the challenges of ICT use. Some projects have managed to be successful in dealing with the circumstances they face in implementing ICTs in rural areas, but some have also failed at different levels. According to Heeks (2002: 2), ICT projects can totally fail, partially fail or be successful:

- **Total Failure:** An ICT project has ended up not being implemented, or a new project has been implemented, but eventually abandoned.
- **Partial Failure:** Major goals of the ICT project have not been attained or significant undesirable outcomes are experienced. A reasonably clear form of partial failure is sustainability failure where a project succeeds initially, but then fails after a year or so.
- **Success:** An ICT project attains its major goals, and does not experience significant undesirable outcomes.

Various rural ICT projects that exist in developing countries fall into one of these categories of project outcome. Assessing the success or failure of ICT projects is somewhat subjective, depending on who sets the goals, and for whom the outcomes of the project are undesirable. Van Belle and Trusler (2005) indicate that some authors see the success of a project in the light of those who fund it, while other authors view success from the perspective of the participants of a

project. Project failure tends to be prevalent and success rare in rural areas, therefore it is important to understand the causes of this, so as to develop the means by which to alleviate the extent of project failure in rural areas (Heeks, 2002: 4). The key is to understand how to work towards making ICT projects sustainable in rural development. Sustainability is not necessarily success, as a project can be sustainable without attaining its major goals. However, if a project is not sustainable, it is still considered a form of failure (partial failure). Therefore, even though sustainability is not the same as success, it is key and necessary for success (Heeks, 2005: 1). Long-term socio-economic rural development can only be supported by *sustainable* ICT projects.

3.3 The Concept of Sustainability

The success or support of ICT projects within the context of rural development relies on the ability of the project to be sustainable. Sustainability should be considered from the start of a project, specifically bearing in mind the factors that influence its sustainability (Munyua, 2000: 7). A number of authors define sustainability in different contexts, with much debate on the true meaning of sustainability, when applying it to different project environments (Batchelor and Norrish, 2002). Sustainability can be described simply as (NetTel, 2005: 59):

> *"Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs"*

It is concerned with an ICT project that endures, and is sustainable, through maintaining and prolonging the services provided (Heeks, 2005; Jacobs and Herselman, 2005: 60). The notion of sustainability takes into consideration whether or not the technology is being put to use to support rural activities that benefit the rural population in that particular area such that the project may be replicated and maintained to influence other areas associated with rural development (IDRC, 2005). Sustainability in this case focuses on two views of analysis, that is, the sustainability of on-going rural ICT access, independent of specific technologies or projects; and the sustainability of rural development results through ICT-enabled development (for example, education, health, empowerment, *etc.*) (TeleCommons Development Group, 2000: 3). The type of ICT project determines the design and sustainability options: specifically whether the aim of the project is to provide a social service to the community, or is commercially driven, with the aim of making a profit (fees for service) from services provided (Accascina, 2000; Hearn, Kimber, Lennie and Simpson, 2005: 20). The meaning of sustainability differs between projects, depending on the purpose of the ICT project.

Sustainability can also be observed from the perspective of investments that continue to provide a return, particularly on rural livelihood assets such as human, financial, social, natural, and physical capital. Ashley and Carney (1999) in Batchelor and Norrish (2002) illustrate this using the Sustainable Livelihoods Framework that focuses on four main capital assets: financial, human, social and physical capital, from which a balance needs to be sought in rural areas. Sustainable systems in this framework accumulate stocks of assets and increase the capital base over time in rural areas. Unsustainable systems deplete capital over time where assets are spent as if they were income, leaving less for future generations to use. The approach to this framework differentiates between different categories of sustainability which are useful in relation to the support of ICTs in rural development.

3.3.1 Categories of Sustainability

Most research considers sustainability to be closely linked to the ability of a project to be *financially* sustainable, in that a project must be capable of cost recovery, in order to be continuously operative and dynamic in the services it provides. Financial sustainability is crucial, and should be the aim of most projects (Stoll, 2003a). However, sustainability encompasses more than just the financial or economic aspect of the project; it also considers other facets of the project. Keniston (2005: 2) indicates that it also means rootedness in local communities, cultural and political acceptance, and value to rural individuals, which to an extent are more important than financial scalability. ICT projects need to take this into account, as McNamara (2003: 32) proposes that most projects prove to be unsustainable in the long-run because they have not been accompanied by, or fail to generate, the broader economic and social changes that would lead to sustainable demand for ICT resources in rural development, especially relative to other demands on scarce resources. In order for a project to reach its goals of community development and sustainability, ICT enabled projects need to *integrate* social, cultural, institutional, economic, political, and technological sustainability as vital elements in the planning and operation of ICT projects (Stoll, 2003a). The different categories of sustainability that influence the success of an ICT project in rural areas include:

- **Social and Cultural Sustainability:** This considers the social and cultural context in which a project operates, and the response of the ICT project to this context. As the ICT project takes into account the social and cultural aspects of a rural community, people in the community feel empowered by the project and hence become active in seeking ways in which to keep the project running, as it is in their own self-interest (Stoll, 2003a). Social exclusion is therefore minimised, and social equity is continually built on and not undermined (Batchelor and Norrish, 2002; European Information Technology

Observatory (EITO), 2002: 250). Stoll (2003a) indicates that men and women, and youth and adults have different needs, interests and possibilities with regard to ICT use. Different social groups in rural areas should therefore be managed differently so that the project team may implement mechanisms that support social or cultural sustainability in a project. The idea of "the Commons" or shared ownership of resources forms the basis for community based ICT projects to be sustainable. Stoll (2003a) differentiates between two types of commons, that is, social commons and physical commons. Social commons are associated with the application of shared community values in terms of, for example, reciprocity (taking care of other people's interests), altruism (increasing social trust with less domineering of groups), trust (to take risks within a social sphere), and social norms that shape community member involvement and participation in the project. Physical commons are associated with public facilities of value and worthy of on-going community support, for example, public halls, schools and a telecentre. All social commons put together form the social capital of a community. Therefore, the stronger the social commons in a community (social and cultural sustainability), the greater the chance of the sustainability of the physical commons, such as a telecentre housing ICT.

- **Institutional Sustainability:** According to Batchelor and Norrish (2002) this category of sustainability is attained when prevailing processes and structures have the capacity to perform continuously over the long term. Aspects of institutional sustainability that need to be put in place include well-defined ICT laws, participatory policy-making processes, and effective public and private sector organisations that develop a framework in which the livelihoods of rural people can be continuously improved. Gerster and Zimmerman (2003: 48) postulate that *ownership* of the ICT project process by local people forms the basis for institutional sustainability. Therefore, sustainability can be augmented by processes and structures that promote well-targeted capacity building, and the development of relevant local ICT content, hence strengthening the empowerment and participation of community members. The IICD, for example, commits 75% of its project resources and time to institution building and training for local ownership and empowerment (Gerster and Zimmerman, 2003: 48).
- **Economic/Financial Sustainability:** This is associated with the level of expenditure that can be sustained in the long term (Batchelor and Norrish, 2002). ICT projects in rural areas are initially funded by development organisations; however, in the long term the ICT services provided need to develop cost recovery mechanisms to generate enough income to keep the project sustainable. Gerster and Zimmerman (2003: 49) and The World Bank (2003c: 84) indicate that the ability for ICT services to be financially self-

sustainable is a key concern; there is a need to promote a spirit of entrepreneurship to market ICT services rendered and secure grant contributions. Furthermore, a cost-benefit analysis, including transaction costs, needs to be implemented so as to differentiate between priority programs and wishful thinking that result in unproven business models. ICT projects should not only focus on non-profitable schemes in a community through the generation of positive externalities (social goods), but also consider the need to expand and sustain the ICT services provided in the long term (Cisler, 2002: 4; Heeks, 2005). Project leaders therefore need to promote a sense of ownership of the project by building lucrative partnerships with the community and creating employment opportunities for increased income, so as to defray all expenses over the long term (Bridges, 2006b). The application of appropriate cost recovery mechanisms can therefore support the institutional sustainability of ICTs in a rural area, and tends to depend on other categories of sustainability for it to be effective.

- **Political Sustainability:** An ICT project is often confronted with political challenges that hinder the progress or sustainability of a project. Political sustainability is important for a project to be accepted by the main governing bodies of a community or country. Stoll (2003a) refers to political sustainability as 'the importance of securing a regulatory framework that will protect, promote, and support community telecentres and their activities, with special attention to the specific needs of the poorest sectors'. A politically sustainable project therefore means that local and national politics, policies and individuals, can influence a project in a positive way (Cisler, 2002: 2). For example, a school networking project in Mexico was so popular that it surprised governing bodies, school administration and a telephone company (that initially had not provided adequate Internet access). This led to invitations to present this project at conferences in Mexico City, hence opening doors to funding of equipment, training and content development, as politicians want to be associated with successful projects (Cisler, 2002: 2). Consequently, it is imperative that rural community leaders are involved in the project process, so that they too can have a sense of ownership of the project and hence encourage the community to support and see the benefit of the project.
- **Technological Sustainability:** This considers the ability to choose technology in an ICT project that can serve satisfactorily for an extended period of time (Cisler, 2002: 3). Telecentres in rural areas do not necessarily have to operate with the latest technologies, but it is important that they plan for ensuring their technological sustainability (Stoll, 2003a). The technology industry is continually changing at a rate that is faster than the demand of rural users of ICT, which to an extent may result in projects that are not

successful because they are too advanced. For example, organizers of a telecentre in South Africa overestimated the interest in Internet access by users, who were more interested in learning basic Microsoft Office programs in order to find a job (Cisler, 2002: 3). However, this may have resulted from limited awareness on how the Internet may have been applied to meeting requirements of these users. The availability of spare parts, hardware, software, and supplies (paper, printer toner, and cables) also needs to be maintained in order to keep the ICT usable for long periods, hence preserving the support and interest of community members. ICT projects also need to consider the acceptance of recycled computers that can save a great deal of initial costs, but repair and replacement may become more difficult and expensive. Furthermore, the type of software used should be appropriate to local use and offer a community of growing local programmers the facility to customise the programs to local standards, which is the case with open source applications. (Cisler, 2002: 3). Altogether, Stoll (2003a) indicates that a rural ICT project or telecentre should not operate in isolation but instead make an effort to collaborate with other rural telecentres through a network, thereby allowing for shared insight and experience, and shared resources and connectivity (for example, reduced connectivity costs through telecentre block deals).

The different categories of sustainability discussed need to be harmonious and integrated in order to achieve overall sustainability in a rural ICT project. Future outcomes of an ICT project therefore depend on the ability of the project to be sustainable in *every* category of sustainability. This idea can be compared to a structure adapted from Hietanen (2002: 6) which illustrates that the socio-cultural, institutional, economic, political, and technological categories of sustainability are equally important and hence there cannot be a situation where one category is sacrificed for another, or one is exchanged for another. The needs, demands and driving forces associated with the different categories of sustainability should be harmoniously combined in a rural ICT project, as shown in Figure 3.

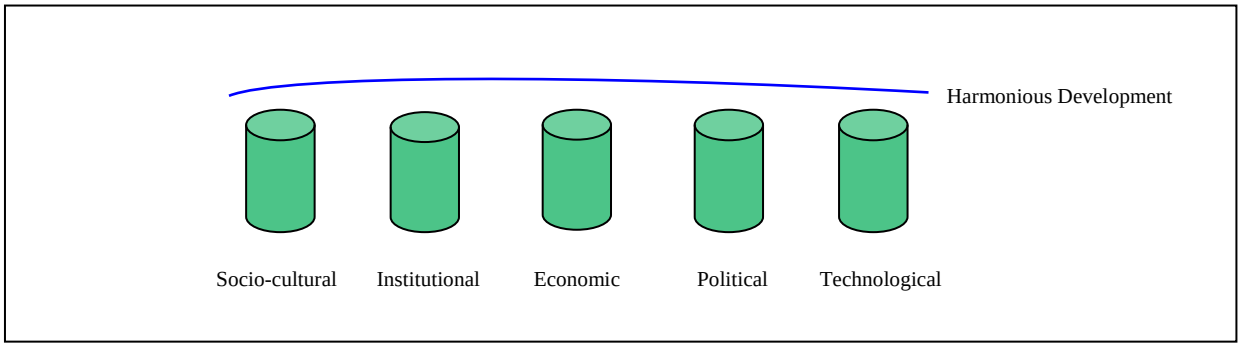

Figure 3: The Structure of Sustainable Development adapted from Hietanen (2002: 6)

The significance of the development of sustainability implies that ICT project implementation needs to be receptive to critical factors that play a role in promoting the sustainability of an ICT project in rural areas.

3.4 Critical Success Factors for Rural ICT Project Sustainability

The categories of sustainability relevant to an ICT project rely on factors that are critical for the development of ICTs in a rural community. A range of project case studies from development organisations reveal the *lessons learned* and *good practice* for the success or sustainability of rural ICT projects. An analysis of these related lessons and good practice disclose critical success factors that need to be applied in order to support the effectiveness of the rural ICT project process. The importance of some critical success factors depends on the objectives of the particular rural ICT project. Nevertheless, most of these factors, to an extent, play a significant role in promoting sustainability across a variety of projects. The critical success factors (CSFs) associated with rural ICT project sustainability include:

3.4.1 Simple and Clear Project Objectives

The introduction of ICTs in the developing world has spurred a level of excitement that has resulted in the implementation of projects in rural areas that have not been appropriately planned with clear objectives to be achieved. According to Bridges (2006a), most people involved in socio-economic development work are inspired by big ideas to improve the world through grand visions, ground breaking innovations, and tireless work. However, this has resulted in ICT initiatives that are characterized by goals that are too lofty and project plans that attempt to accomplish too much in too little time.

Clear and simple project objectives sensitive to the target community's needs and limitations are therefore vital for the effective sustainability of a rural ICT project (IDRC, 2004: 49; Talyarkhan, 2004: 9; UNDP *et al.*, 2001: 17). Clear objectives need to be determined for specific phases of implementation in a project, hence setting out a solid realistic plan of small achievable steps and adhering to them (Bridges, 2006a; IDRC, 2004: 49). Appropriate timeframes for realistic deliverables for each phase can be set, considering the specific constraints faced in rural areas. Accountability for deliverables can therefore be communicated to stakeholders of the project, so that they are clear as to who is responsible for completing certain tasks and activities in a given time period. This improves the monitoring and evaluation of a project such that a growing problem can be picked up in time, and specific measures (change management) to deal with the problem can be implemented effectively (Bridges, 2006a).

However, it is important that goals are not set too high as this can result in too much pressure on staff to deliver, and if the project does not deliver, the community will develop a sense of discouragement and distrust. As clear and simple objectives are developed, it is vital that they are accepted by the majority of stakeholders (particularly the target community), with regular meetings and updates to keep them informed about the progress of the project (Batchelor and Norrish, 2002; IDRC, 2004: 49).

3.4.2 Approaching the Project in a Holistic Way

The application of a holistic systematic approach to an ICT project helps to clarify how the project can relate to the rural community at large. An ICT project can not be implemented in isolation of the information systems and activities that make up a community. This concept relates to the Three Sphere Model by Schwalbe (2006: 41) (discussed in Chapter 1), whereby a project should not focus unduly on its immediate and narrow concerns, but keep in mind the specific interests and needs of the rural community in relation to the capability and sustainability of the technology. An ICT project should therefore address a variety of interrelated dimensions in rural development in order to secure a more enduring impact (UNDP *et al.*, 2001: 18). ICT intervention that is pursued in this manner can therefore create synergies both locally and nationally, which stand alone projects cannot achieve. For example, the Sita project that focused on ICT training was not sustainable initially, and subsequently adopted a more holistic approach associated with internships and job placements after training (Batchelor and Sugden, 2003). In this case, as ICT acts as an enabler in rural development, project stakeholders can work together through partnerships, also setting the groundwork for community members who have been trained in ICT. Aspects of a rural ICT project that are addressed via a holistic strategy include building human capacity, creating a favourable environment for enterprise (tax and trade policies), infrastructure development, and a transparent, inclusive and open stance on policy (UNDP *et al.*, 2001: 30). These areas are more effective if they work together as part of a coordinated strategic approach (UNDP *et al.*, 2001: 30). Most of the critical success factors linked to sustainability are therefore based on applying this holistic approach to a rural ICT project.

3.4.3 Using ICTs to Enhance Existing Rural Development Activities

Applying the holistic approach, ICTs should be used as a tool to enhance *existing development activities* in rural communities. ICT projects need to be integrated and anchored into local organisational and rural development activities and processes (Batchelor and Sugden, 2003; Ferguson and Ballantyne, 2002: 2). It is necessary for the ICT to be part of wider development

plans and processes such that broader development issues and goals can be addressed by ICTs, hence providing a more immediate and identifiable development benefit. For example, infoDev case studies illustrate how Voxiva used ICT to develop an early warning system for epidemics, CDI (Committee for Democracy in Information Technology) in Brazil promoted social mobilization, and Cemina promoted gender awareness and empowerment through strengthening women's leadership in community development using Internet radio (The World Bank, 2003c: 10). Therefore, at the start of a project, the project team needs to identify the development organisations already working in a rural community, and collaborate and become aware of their development activities.

3.4.4 Cultivating an Enthusiastic Influential Project Champion

The existence of an enthusiastic ICT project champion is essential to the sustainability and success of a rural ICT project. The UNDP (2001b: 5) defines ICT champions as:

> *"Individuals who combine some level of technological expertise with an enthusiastic understanding of what technology can do for the targeted stakeholders within countries, governments, organisations, enterprises or communities."*

ICT champions essentially inspire, drive, and encourage the targeted community to use ICT, thereby facilitating the introduction of ICTs as smoothly as possible (TeleCommons Development Group, 2000: 11; UNDP, 2001b: 5). It is therefore important that they are considered in the project from the start, as they can develop awareness and belief in the project objectives and methodology toward supporting rural development. Subsequently, they can effectively communicate this to the rural community and make an effort to keep the project on track (troubleshoot) in terms of achieving its goals (Batchelor and Sugden, 2003; UNDP, 2001b: 5).

Different types of individuals in a rural community can take up the role of project champion; the trend, however, seems to focus on national/local visionaries, inspiring teachers, and community leaders or members (IDRC, 2004: 50; UNDP, 2001b: 5). IDRC (2004: 50) postulates that ICT project champions need to possess the skills of visionary leadership, good communication, project management (in some cases), excellent lobbying and negotiation skills. In effect, they need to have strong levels of enthusiasm and strong networks in public and private sectors influencing the rural community.

According to the IDRC (2004: 50), the role of a project champion should not be equated to that of a full-time paid staff member; usually the role is on a part-time or volunteer basis. In

addition, it is also important to consider the reliance on one or a few individuals to drive a project. This can pose a risk to sustainability as a project can easily subside when these individuals leave the project. Therefore, even though it is vital to have a project champion, in the long run, SchoolNet, for example, declares it imperative to train and build the capacity of a team of SchoolNet leaders and managers with the purpose of avoiding dependence on individuals (IDRC, 2004: 50).

3.4.5 Incorporating Socially Excluded Groups

In order for ICTs to have a positive impact and be socially sustainable for rural development, various social groups in the community should have equal access to them. Socio-economic development which aims to serve humanity and promote equity is dependent on the effective participation of these social groups, in particular considering those who are discriminated against (Bridges, 2006a). However, the trend in ICT access in rural areas has been toward the more privileged groups, as identified in the discussion of the challenges of ICT use in rural areas.

ICT projects should incorporate social cultural factors (for example, gender awareness) into policy formulation, planning, implementation and the evaluation of projects, considering these factors from the start of a project (Ferguson and Ballantyne, 2002: 11; TeleCommons Development Group, 2000: 13; UNDP, 2001b: 11). The approach to this is to actively promote the participation of women or youth as ICT users, managers, vendors, and entrepreneurs through for example, considering gender relations, roles, and patterns to resource access (CIDA, 2003: 6). It is important to understand the power dynamics and politics around discrimination and division in particular societies and economies, so as to focus on marginalised groups (Talyarkhan, 2004: 13). Subsequently, project managers become aware of the needs and limitations faced by social groups and hence plan for steps to mitigate the discriminatory access to ICTs (Bridges, 2006a). For example, the Grameen Village Pay Phone scheme incorporated women entrepreneurs in the project by placing them in charge of the cellular handsets, which resulted in increased use of the technology by women (UNDP, 2001b: 11).

3.4.6 Incorporating/Awareness of specific ICT Policy Influencing the Project

A suitable policy environment is necessary for ICTs to be sustainable (institutional sustainability) in a rural community. ICT policies are usually set by national government and international agencies at discussion events such as the ITU (International Telecommunication Union) discussions on telecommunication policy (World Summit on the Information Society), and UNCITRAL (United Nations Commission on International Trade Law) development of

model law, and subsequently implemented through laws and regulation at national level to form a framework for governing the country (Bridges, 2006b). The impact of ICT law, regulation and macro-economic policies in a country can either hinder or foster the effective uptake of ICT as an enabler in rural development (Batchelor and Norrish, 2002; Bridges, 2006b; Talyarkhan, 2004: 8). For example, some policies discourage foreign investment in local technology through high taxation or currency controls, while other policies foster ICT use through permitting Voice over Internet Protocol (VoIP) (recently implemented in South Africa (Hiles, 2005)).

Talyarkhan (2004: 8) and Stoll (2003b) emphasize that development projects need to research the policy environment, and understand the issues arising across the country and regions, especially considering policy that affects rural ICT implementation both directly and indirectly. Governments cannot work in isolation when it comes to formulating policies, as they sometimes do not understand the implications of existing laws and regulations that they impose on the end user (Bridges, 2006b). ICT project stakeholders need to be aware of these policies so as to understand how they influence the sustainability of the project, and hence take measures to enhance or mitigate the effects. In the long-run, development projects should consider engaging in advocacy activities, so as to work with government in helping to frame appropriate policies, balance needs and views of constituencies, and ensure that ICT policies are implemented in rural areas effectively (Bridges, 2006b; Stoll, 2003b; TeleCommons Development Group, 2000: 7). Talyarkhan (2004: 8) indicates that participation is also key in attaining co-operation from government, through recognizing the power relations in a country or region, and hence possibly building strong relationships with policy makers and communicating the potential benefits of the ICT projects. ICT Stories (InfoDev and IICD) (2004) in Talyarkhan (2004: 8) further explains:

> *"Co-operation from local government is to be taken into account in a lot of projects. Either because project initiators need authorisation from local government to start their project, or because the local government may even be a partner…they will not co-operate to the fullest if they feel that empowerment coming from the project will challenge their positions of power."*

In order for ICT projects to take part in and be aware of policy formulation, it is advisable to appoint an individual employee or partner organisation to network, lobby, monitor, document, evaluate, and disseminate ICT policy discussions and developments (Ferguson and Ballantyne, 2002: 2; Stoll, 2003b). The appointed representatives can also work on behalf of the community through communicating their views and priorities to policy makers, and informing them of the current changes to the policy environment that affects their ability to use ICT. For example, in Latin America and the Caribbean (LAC), the Somos@Telecentros Network has introduced a

LAC Telecentre movement that works at grassroots level and is uniquely positioned to act on behalf of communities who would otherwise be voiceless in policy debate (Stoll, 2003b). Somos@Telecentros actively participates in relevant conferences, forums, meetings and public consultations in order to represent the community's view to politicians, policymakers, and other stakeholders.

In operation, rural ICT projects need to consider how the policy environment will affect the project and plan accordingly and devise a project that works within existing policies in a country (Bridges, 2006b; Talyarkhan, 2004: 8).

3.4.7 A Good Understanding of the Local Political Context

While ICT development projects become more aware of the ICT policy environment, it is also vital that the *local* political context of a rural community is understood. The introduction of ICTs to a community can be perceived as a threat to local authority, such as government officials and traditional village leaders (TeleCommons Development Group, 2000: 11; UNDP, 2001b: 7). If there is no political support of the ICT project, achieving community buy-in will be a challenge as political power is considerably influential in rural communities.

ICT projects need to take steps to understand the local political environment (linked to the policy environment) and subsequently achieve political support in the project. It is risky not to be sensitive to local political cultural systems and players. For effective project management, local elites, their factions and interests need to be identified, and understood and considered directly in the project (Bridges, 2006a; UNDP, 2001b: 7). Local political gatekeepers should then be encouraged to participate in the project process so as to create an awareness and understanding of the development benefits of the ICT project. In effect, participation and buy-in from local political leaders requires a constant flow of communication to generate awareness which allows the project to be less vulnerable to any significant political shifts when they occur; for example, newly elected officials or community headmen (Ferguson and Ballantyne, 2002: 7). The project also needs to build in time to introduce any newly-elected political leaders to the project (Bridges, 2006a).

In some cases, the ability to deal with the root of political challenges may be beyond the scope of the ICT project, for example, changes in local government structure, political power, laws, and regulations. Bridges (2006a) advises that it is nevertheless crucial to takes steps to mitigate the effects on the project, and hence adapt the approach in the political environment as needed.

3.4.8 Significant Participation of Community Target Groups in the Project Process

The participation of the community in the planning, analysis, design, implementation, and evaluation of an ICT project is essential for sustainability, as the ICT project team usually consists of people external to the community. There are many ways in which participation can be understood, but an appropriate definition for an ICT project is given by the IDRC (2003: 11) who defines participation as:

> *"An organised effort accomplished by the members themselves with a view to achieving the development objectives that they had assigned to themselves"*

Participation aims to create the conditions in a project required to speed up and make appropriate the purpose of ICTs in the rural context, based on the expectations of the community. The ICT project is associated with new or foreign technology to the community; therefore it is important to raise awareness of the possibilities of the project, so as to deal with false expectations which inevitably lead to disillusionment and eventually disengagement from the project (TeleCommons Development Group, 2000: 11; UNDP, 2001b: 6). The participation process enables the project team to communicate the goals of the project, and empowers the community to express their requirements, needs, and limitations with which they are faced (Mphahlele and Maepa, 2003: 224; Talyarkhan, 2004: 9; UNDP, 2001b: 5). For instance, the Swaminathan Research Foundation's Village Knowledge Centres considered careful advanced preparation in the ICT project that engaged the views and needs of the community, as a success factor (UNDP, 2001b: 5). Participation also enhances sensitivity to the community's social environment (including gender roles and expectations, traditional values, and cultural norms), which is a key area to understand in an effort to promote sustainability in rural areas (The World Bank, 2003c: 81).

A number of aspects need to be considered when applying the participatory approach in a rural ICT project. These include:

- *Selecting target groups to participate*: The project obviously cannot include every community member in the participatory process, especially in the case of large communities. The tendency has been to limit community involvement to a small number of community leaders, but cultural and political issues have prevented producing truly participative outcomes as intimidation results in restrictions to 'who can say what', and 'how' within a group (IDRC, 2003: 60; UNDP, 2001b: 8). Management committees that represent the whole community, and reflect its existing social groups (women and youth) specifically need to be established (IDRC, 2003: 62; Batchelor and Sugden, 2003). In addition, political gatekeepers and local information intermediaries need to be involved.

The selected innovative target groups play a significant role in serving as access points to the community and in their contribution toward developing strategies designed to identify and involve dynamic groups who are likely to use ICTs in early stages of the project.

- *Introduce the goals and benefits of the project*: Since the community is being introduced to foreign technology, they need to understand the importance of ICT in acting as a tool to enhance rural development. Target groups can also be involved in the identification, formulation and implementation of project goals, hence stimulating awareness and acceptance of the project, which creates a firm foundation in the community (Ferguson and Ballantyne, 2002: 4). As a result, role identification, clear project definition and communication of the project's vision enable stakeholders to relate to the project, and thereby facilitate the mobilisation of participants towards achieving the goals.
- *Identify the limitations and risks in the community*: target groups need to communicate the limitations and challenges with which the rural community is faced, and that can act as a barrier to effective ICT use. It is vital that the project team is aware of these, so that they may plan accordingly to deal with or mitigate the limitations faced. The impact that ICT will have on the social, political and cultural norms of the community should also be accentuated, so as to consider these aspects in the implementation of the project (Batchelor and Sugden, 2003). Bridges (2006b) emphasizes that the community also needs to be aware of the risks associated with the use of ICTs, especially the Internet, that is, where users can become more susceptible to scams and fraud.
- *Perform a needs assessment and local content development*: ICTs projects in rural areas should be developed according to the needs of the community, hence considering development of local content. Demand driven needs are critical to the success of a project. (see section 3.4.9, 'Focusing on Local/Demand Driven Needs')
- *Provide continuous communication and feedback*: Target groups need be informed of any changes or enhancements to the ICT project on a continuous basis (Batchelor and Sugden, 2003). Feedback also needs to be encouraged so that the project team may receive direction and are aware of where the project is heading in the community.

The IDRC (2003: 62) indicates that it is necessary to differentiate between the type and mode of participation as well as the participants at different stages of project implementation. For instance, at the launching stage especially, it is important to select community members who have innovative attitudes and are risk takers. One way in which to measure the level or influence of participation as a critical success factor in the community is to weigh the level and intensity of the community's reaction to a particular action in the project (IDRC, 2003: 62).

3.4.9 Focusing on Local/Demand Driven Needs

It is imperative that ICT projects implemented in rural areas meet the local needs of the community. Keniston and Kumar (2003: 16) relate that some enthusiastic projects in rural areas have been developed with the intention of placing "a computer in every village", scatter "info kiosks" throughout the nation, and establish "universal computer based education". This has been put into practice, not considering the assessment of real local needs, hence resulting in projects that are not sustainable as they do not serve the community's requirements for ICT services. This brings into context the need for ICTs to focus on being demand driven and not supply driven, in accordance with the assessed needs for information and services (Batchelor and Sugden, 2003; Bridges, 2006a; Chapman and Slaymaker, 2002: 22; Conradie, Morris and Jacobs, 2003: 204; Munyua, 1998: 15; TeleCommons Development Group, 2000: 5; UNDP, 2001b: 13; UNDP *et al*., 2001: 17). ICT projects should be developed in relation to the demand responsiveness of the community, which refers to (Ferguson and Ballantyne, 2002: 4):

> *"The extent that the activity directly responds to the needs of various stakeholders and beneficiaries, and provides opportunities for these groups to themselves determine the priorities to be followed and the actions to be implemented."*

A project, like a business, is required to understand the market it aims to target. Bridges (2006a) states that different communities operate in diverse local conditions, based on the needs and desires of the people, and the factors that influence their uptake of technology. Furthermore, Keniston and Kumar (2003: 16) indicate that communities also have different populations, economic bases, cultures, social organisation, and levels of need. A project needs to move away from an 'All for One' mentality that assumes the uniformity of needs in distinct communities. Therefore, a project should conduct a thorough needs assessment or analysis that determines the requirements of particular communities, thereafter adapting the technology to suit and serve their needs (Stoll, 2003b; Keniston and Kumar, 2003: 16). Otherwise, ICT projects imposed on a community that has not independently determined a need for it through project participation are more likely to fail or not be sustainable. For example, a telecentre that was established in Mankweng, South Africa, became unsustainable (Mphahlele and Maepa, 2003: 224). On investigation, it was discovered that the community consisted of households that were fairly affluent, had a telephone, and in some cases had a computer at their work places. A needs assessment would have determined the necessity or otherwise of a telecentre in the community.

Munyua (1998: 15) and Bridges (2006a) point out that the demand for ICTs in rural areas is not prominent due to the fact that it is foreign technology to most people, and therefore awareness creation and campaigns with training should be encouraged. Since the community lacks an

understanding of what ICTs can do for it, it is difficult for them to articulate their technology needs in relation to their rural development goals. An ICT project should stagger their approach to eliciting user requirements in order to stimulate demand through (Bridges, 2006a; Chapman and Slaymaker, 2002: 23):

i. Initially focusing on educating the community on the potential use of ICTs through training, and
ii. Then encouraging users to communicate their user requirements for ICT with their knowledge of its potential

The idea is firstly to introduce the project to the community in a simple manner. Sustainable ICT projects in Senegal present a strong example of 'keeping it simple' initially and then expanding the ICT services provided according to the stimulated demands of the people (TeleCommons Development Group, 2000: 5). Training should focus initially on advertising the ability of ICTs through, for example, basic computer literacy courses.

Various methodologies are available for assessing the needs of a community. The Participatory Rural Appraisal (PRA) is a common methodology that provides a model to engage the community in helping to define and determine their own needs (Mphahlele and Maepa, 2003: 222; Talyarkhan, 2004: 9; UNDP, 2001b: 13; Warschauer, 2003: 90). In order to maximise the community's involvement in determining their needs, PRA makes use of focus groups, interviews, door-to-door surveys, community meetings, and special participatory exercises. An intensive PRA approach has been used in successful ICT projects in India, such as Gyandoot and the M. S Swaminathan village knowledge centres, to assess the information needs and determine which villages were most likely to benefit from the services (UNDP, 2001b: 13; Warschauer, 2003: 91).

A needs assessment is likely to reveal, for instance, vital information that is lacking, limited or available in rural development, local capacity to use technology, availability of technical support, the kinds of services people would be willing to pay for, and what services need to be provided free *etc.* (Bridges, 2006a).

However, it is important to note that when assessing the needs of the community, every need or interest need not be accommodated, but instead, room should be left to respond to demand as usage patterns emerge and active needs can be identified (Jacobs and Herselman, 2005: 17). Ferguson and Ballantyne (2002: 4) indicate that demand is dynamic as a result of being tied to socio-cultural and political processes. Flexibility in project design and execution therefore needs

to be applied, especially as the expectations and awareness of ICTs are augmented. Demand should be checked and continuously monitored through active participation and feedback from stakeholders.

3.4.10 Building on Local Information and Knowledge Systems

Developing ICT projects based on traditional information and knowledge systems is vital for sustainability, especially considering the necessity to customise and utilize ICTs according to the demand driven needs of the rural community. Local knowledge that is widely disseminated can be more effective in supporting rural development activities for instance, than foreign information that is available on the Internet (UNDP, 2001b: 13). Building on existing knowledge systems instead of introducing new ones that undermine traditional, local communications can encourage large scale adoption and integration into the daily lives of rural people (Bridges, 2006b; Talyarkhan, 2004: 19), as was the case in successful ICT projects in Uganda and Senegal that were sponsored by the IDRC (IDRC, 2003: 62). Taking into consideration the local context associated with sharing knowledge created from social interactions between people, ensures that information can be substantially understood and internalized.

The ICT project team should conduct a careful research study of the existing information and knowledge systems in the rural community (UNDP, 2001b: 13). This will assist in determining how information is traditionally gathered, stored, shared, and evaluated. In addition, while designing the ICT program, the project team can essentially become aware of the different ways in which rural people learn, communicate, and use traditional information (Batchelor and Sugden, 2003). Rural people can therefore also be seen as producers of information. Potentially, information intermediaries in the community who are familiar with local information and knowledge systems can play a significant role in linking the technology to community activity (UNDP, 2001b: 11).

3.4.11 Appropriate Training and Capacity Building

Training and capacity building are priorities in the implementation of any rural ICT project, and form a vital part of the project process. The community needs to make sense of the potential of ICTs by directly engaging and understanding how to use and creatively adapt the technology to their rural development activities (Bridges, 2006b). Generally, training and capacity building equip and empower communities to build up necessary ICT and business skills to integrate in community learning and business opportunities (Conradie *et al.*, 2003: 207). No ICT equipment

should be introduced without providing the necessary training to use the technology, as insufficient training jeopardizes the sustainability of the project in the long-run. A skills audit should be conducted continually throughout the project, to identify the existing skills and aptitudes in the community, and subsequently determine the capacity gaps that limit the ability to use ICTs (Ferguson and Ballantyne, 2002: 10; TeleCommons Development Group, 2000: 11). This enables the project to provide sufficient and on-going training for the community to effectively take advantage of ICTs.

Specific stakeholders in the community play an important role in regularly training the community in the long-run. The project team needs to focus on key gatekeepers in the community, especially those representing target groups (TeleCommons Development Group, 2000: 14; UNDP, 2001b: 4). Batchelor and Sugden (2003) explain that training should be provided at all levels according to community need, particularly for marginalized groups in the community. The UNDP *et al.* (2001: 34) suggest, for example, that the critical mass of people that need to be trained to use ICT as an enabler include knowledge workers, intermediaries and technology users, and motivated entrepreneurs. In particular, local knowledge workers and intermediaries play a key role in the project process as they are involved in gathering, capturing, translating, packaging and disseminating relevant local information (Talyarkhan, 2004: 12; UNDP, 2001b: 13). In their capacity to use ICT, information intermediaries and knowledge workers serve as important bridges by helping impoverished end-users and illiterate community members to benefit from the uses of ICT (UNDP, 2001b: 11).

A community needs to be introduced and trained initially on how to use ICT (for example, basic computer literacy such as PC literacy, e-mail and Internet usage, hardware and software skills (Conradie *et al.*, 2003: 207)) to gain confidence in using the technology. Subsequently, other aspects of training and capacity building should follow in order to promote the sustainability of the project. Training should therefore consist of (Batchelor and Sugden, 2003; Bridges, 2006a; Conradie *et al.*, 2003: 208; Ferguson and Ballantyne, 2002: 2; Jacobs and Herselman, 2005: 77; Stoll, 2003b; TeleCommons Development Group, 2000: 11; UNDP, 2001b: 13):

i. *Content Development:* A community needs to be trained to produce ICT content that is relevant and applicable to their rural context.
ii. *Technical support:* for setting up the ICTs and maintenance of the technology in the absence of the project team.
iii. *Business and Development Activity support:* Support needs to be provided for users to not only access information but also to *act* upon that information.

> Capacities need to be strengthened to design, decide upon and execute ICT-enabled activities. In this case, as ICTs are introduced, a business skill development programme should form part of the training so as to equip people with the ability to effectively use ICT for entrepreneurship.

Training in the project process should be associated with an appropriate training structure to apply to the rural community, such that training can be effective and widespread. At the outset, Conradie *et al.* (2003: 208) suggest it is important that suitable people from the community are selected to be trained so that they may eventually be trainers themselves with a locally adapted training structure, and interviews should be conducted to select suitable candidates. Furthermore, the IDRC (2004: 51) recommends that a formalised mentorship programme exists to diffuse skills within the community in addition to a management structure with shared knowledge mechanisms in place to maximize on capacities. In this sense, ICT itself can be used to retain any in-house community learning hence producing a hub of information applicable to the community that can be referred to for further learning when needed. As training should be continual, refresher training courses must be provided, which was, for example, applied on a monthly basis in the Tsilitwa ICT project in South Africa (Conradie *et al.*, 2003: 208).

3.4.12 Facilitating Local Content Development

As an ICT project researches and attempts to understand the knowledge and information flows of a rural community, it needs to recognise community members as not only just consumers of information, but also producers of locally relevant information and knowledge (Stoll, 2003b). The community needs to engage in local content development that is sensitive to the local rural environment in which the ICT project is being implemented. Local ICT content comprises information that is locally relevant, meaningful, and applicable in local realities for rural target groups to benefit from (Bridges, 2006b; Danish International Development Agency (Danida), 2006; Talyarkhan, 2004: 11; The World Bank, 2003c: 81; UNDP *et al.*, 2001: 38). Examples of locally relevant content that should be disseminated effectively to rural communities include educational materials, health information, environmental data, agricultural extension services, and indigenous knowledge (Bridges, 2006b).

The targeted population needs to be actively involved in identifying the content needs of the community. They play a significant role in defining content requirements, collecting local data, and authoring and publishing content that is sensitive to the socio-cultural context of the community (Talyarkhan, 2004: 13; Warschauer, 2003: 90). In effect, target groups need to be

trained and instructed on how to collect information and reorganize it in a comprehensive meaningful manner that is locally understandable (Stoll, 2003b; TeleCommons Development Group, 2000: 12). For instance, a sustainable Youth Cyber Club in Senegal applied a strong focus on local content development through using related information on family planning and sex education that they were trained to search for on the Internet (IDRC, 2004: 53). Importantly, ICT projects must plan for the integration of instruction on how to apply *creative skills* to local content development (Batchelor and Sugden, 2003).

Certain aspects of local content development need to be considered and applied in the process. Language compatibility is important as most ICT based information is available in English, or major northern languages like Japanese, Chinese, French *etc.*, fanning the need for translation workshops, and the development of standard language fonts and symbols (Danida, 2006; Keniston and Kumar, 2003: 9; Talyarkhan, 2004: 11; UNDP *et al.*, 2001: 38). Other aspects that must also be considered include communication habits, cultural norms, literacy, use of appropriate taxonomies, and intellectual property rights (creative commons).

3.4.13 Existing Motivation and Incentive for ICT Job Placement in the Community

The economic status of a rural community can influence the sustainability of a project, especially considering the expectations of the community, and the ability to afford the ICT services provided. Economic growth is key to expanding the use and affordability of ICTs. ICT projects should focus on creating job placements as community members acquire ICT skills, so that they do not leave their families in search of employment elsewhere (Bridges, 2006b; The World Bank, 2003c: 86). Failed community access to ICT services can generate negative attitudes toward the project, as community members may feel that the funds used in the project could have benefited the community in another way, especially if they lose skilled labour. Furthermore, some technologies can replace certain jobs, such as cutting the middleman, leading to job losses (Bridges, 2006b).

ICT project training should not only focus on basic computer literacy, but also ensure that the skills acquired respond to the job market need, assist trainees with job placements, and equip them with proactive skills for finding jobs (The World Bank, 2003c: 86). A telecentre, for instance, requires appropriate management and administration skills. According to Mphahlele and Maepa (2003: 227) and Bridges (2006a), suitably trained people to work in the telecentre should originate from the community. Local people are needed to fill telecentre job positions, as

they understand the politics, culture and dynamics of the community, and have a local entrepreneurial spirit, hence ensuring effectiveness and sustainability of the ICT project. An effort should be made to retain human resources, in-house skills, and intangibly support project participants, thereby motivating and providing incentives for local staff to continue working in the community telecentre (Bridges, 2006a; Dymond and Oestman, 2004: 53; Ferguson and Ballantyne, 2002: 10).

3.4.14 Focus on Economic Self-sustainability - Business Development (Entrepreneurship)

The economic sustainability of a project depends on rural ICT initiatives taking into consideration possible businesses that can arise from the project. Although, at the early experimental stages of a rural ICT project, ICT services are provided free of charge to build up awareness and confidence in use, the community should not become entirely dependent on donor funding. A rural ICT project in this case will not be sustainable, once donor funding discontinues (The World Bank, 2003c: 84). Rural ICT projects are advised to plan with a sound business model to promote a self-sustainable economic base, for instance, for a telecentre, such that it can have a substantial impact on the community (Bridges, 2006a; Ferguson and Ballantyne, 2002: 10; Keniston and Kumar, 2003: 18; Mphahlele and Maepa, 2003: 224; UNDP *et al.*, 2001: 17). Bridges (2006a) highlights that a business plan should be developed, whether the ICT service in the community is for profit or not.

Entrepreneurship and creativity need to be fostered in rural areas, as the economic environment in which they operate eventually determines the extent and frequency of ICT use in the long-term (Ferguson and Ballantyne, 2002: 10; Bridges, 2006b). Entrepreneurs can make a positive impact in the community through, for example, developing local content and providing training and access to communication tools. A telecentre, for instance, must operate under business principles for generating income to enable the community to make realistic demands and understand the dynamics of running the telecentre. As the community pays for the services provided, they become aware of the costs of providing services, such as maintenance of equipment and purchasing paper or toner.

From the outset, a solid business model or plan should include mechanisms for growth and replication in the community, so as to offer scalable and sustainable entrepreneurship solutions (UNDP *et al.*, 2001: 17). In South Africa, some digital villages have not been successful or sustainable as they did not include any business plan, cost recovery system, marketing strategy

or emphasis on local community services. As a result, the Universal Service Agency (USA) of South Africa that funds projects, now requests that a detailed business plan is provided as part of the application process for approval (Mphahlele and Maepa, 2003: 224). This business plan describes the business project's rationale, demand basis, costs, expected revenues, and financial performance (Dymond and Oestman, 2004: 51). Dymond and Oestman (2004: 51) provide a list of aspects that are considered in a business plan for a typical phone shop, telecentre or network of such facilities (These are shown in Appendix B).

The initial stages of ICT related business or entrepreneurship development in rural communities need external funding in order to start up. A steady flow of external funding is required to grow and replicate ICT projects (Ferguson and Ballantyne, 2002: 10; The World Bank, 2003c: 84). According to The World Bank (2003c: 84), external funding is not particularly needed for ICT components that are unique and expensive, but to help in developmental interventions that change the existing information communication systems in the rural community. In this case, local businesses can also form strategic alliances with partnership organizations that can help with contributions in-kind, for example, technical support, accommodation, software, hardware, and volunteers.

3.4.15 Encouraged Local Ownership

Ownership is grounded in most of the critical success factors already discussed, such as community participation, training and capacity building, local content development, entrepreneurship *etc*. The sustainability of a project depends on the ability of the community to take ownership of the ICT project process. Ownership plays a significant role in setting the foundation for local buy-in and is crucial for relevance, effectiveness, efficiency, impact and hence the sustainability of rural development activities (Ballantyne, 2003: 2). According to Siochrů and Girard (2005: 19) a combined definition of community ownership comprises three aspects where the concept of ownership is considered as a process of internalisation of *responsibility*, *legal ownership* and *degree of decision-making* for the ICT development process and its outcomes. Ownership translates into a willingness to invest effort and resources in the project.

Ownership needs to be stimulated from the start of the project or be part of the inception phase, so that local creative communities can be strengthened to own the project's processes and results (Ballantyne, 2003: 2; Bridges, 2006a; Ferguson and Ballantyne, 2002: 2). A particularly important notion of local ownership is that it should be *taken* from the start, and not *given*.

Ballantyne (2003: 8) indicates that some donors and development agencies tend to dominate ownership (especially in the beginning) of the project without really considering local ownership. The limited involvement and participation of the community is unlikely to produce sustainable results. Therefore, local stakeholders that drive the creative ability of the project should be empowered to take ownership of the project especially through:

i. Processes of transformation (education, awareness raising and local engagement) and capacity building (in, for example, soft skills in finance, business management and communication). This helps to put the local needs into context as local stakeholders become truly creative communities that drive and own the project (Ballantyne, 2003: 3; Bridges, 2006a; CIDA, 2003: 6; Ferguson and Ballantyne, 2002: 7; Siochrú and Girard, 2005: 44).

ii. External actors (for example, donors) involved in the design and formulation of projects need to limit their direct roles and responsibilities in the project, and encourage local stakeholders to take the lead and participate more in the project. This limits external control of the project which weakens sustainability through interference and overdependence on external actors (Ballantyne, 2003: 3).

Different types of ownership can exist in a rural ICT project, and this varies between different types of projects (Ferguson and Ballantyne, 2002: 5). The type of ownership assumed by local stakeholders at different stages of the project needs to be re-defined accordingly, as the ownership of the project is dynamic and embedded in the social context. Community ownership is a process that is built over time, through growing capacities, understanding and commitment. Consequently ownership depends on how the ICT project evolves, such that owners at the start of the project may not be the same at the end, and new owners take over along the way, depending on their capacities to be owners. Ballantyne (2003: 4) indicates that the process of ownership therefore needs to develop mechanisms where:

> *"owners can meet, engage in dialogue, where they can become 'decision-owners', and where roles and responsibilities are reviewed, and, if needed, adapted to evolving situations"*

This is important to practice, as Mphahlele and Maepa (2003: 226) emphasize that optimal transparency and appropriate representation should be considered in community ownership. Potential local leadership representation can originate from grassroots NGOs, local self-help groups, or from locally elected officials and traditional leaders (Siochrú and Girard, 2005: 44). Suitable representation and transparency may subsequently mitigate the influence of local politics in determining which local stakeholders will own or lead the project.

3.4.16 Building Local Partnerships

The sustainability of a rural ICT project depends on the contribution and involvement of particular local actors in the community. Most research indicates that partnership with these actors has the potential to increase the reach and impact of an ICT project in a rural community (Bridges, 2006a; Stoll, 2003b; Talyarkhan, 2004: 19; The World Bank, 2003c: 81; UNDP *et al*., 2001: 30). Bridges (2006a) specifies that the integration of ICT in rural development, especially using a holistic approach, can be complex and manifest in different ways, in different communities and countries. Such challenging issues tend to be out of the scope of the project; therefore partnerships and collaboration are necessary to promote project impact and sustainability.

Partnerships are built on existing formal and non-formal local/national organisations that operate as public or private institutions (Batchelor and Sugden, 2003). Stakeholders in the project who can collaborate to support ICT as an enabler of rural development include government, private sectors, NGOs (civil society groups), community groups, proponents, and donors (Mphahlele and Maepa, 2003: 230; Stoll, 2003b; Talyarkhan, 2004: 9; TeleCommons Development Group, 2000: 4; UNDP, 2001b: 4). Talyarkhan (2004: 9) defines these organisations as information providers, organisations that promote services and raise awareness, and organisations that offer technological infrastructure and finance to keep the project going. For example, the SchoolNet ICT project was advised to integrate their activities with national strategies that involve the following stakeholders (IDRC, 2004: 53):

- Government who can support ICT enabling policies
- Internet Service Providers for low-cost Internet access
- Telecommunications companies for low-cost telephone access
- Ministries of Trade for low-cost imports of computers and software; and
- NGOs, such as teacher unions, to cultivate support among teachers for the SchoolNet initiative

The South African Department of Home Affairs partnered with an ICT project in ga-Seleka, where the Phalala telecentre was used as a satellite office for the department (Mphahlele and Maepa, 2003: 230). People were able to use the photocopy machine and camera available for personal identity documents. This partnership acted as a marketing strategy for people to use other services provided in the telecentre.

The essence of partnership is that different actors have special competencies and capacities based on their particular mandates that can contribute to rural ICT project sustainability in the form of

finance and/or non-financial support (in-kind contributions usually) (IDRC, 2004: 52; UNDP, 2001b: 17). Some actors, for instance, have more resources, special links to grassroots and special interest groups who have social-cultural and political influence, and are closely linked to national policy and decision makers. Working with partners who share the same objectives pools expertise and knowledge, concentrates resources, and supports government in making the best strategic initiatives toward ICT for rural development (UNDP, 2001b: 17; Ferguson and Ballantyne, 2002: 2).

The appropriate partners, locally and nationally need to be researched and identified in order that their capacities and competencies can be reviewed for potential partnership (The World Bank, 2003c: 81; UNDP 2001b: 17). It should be investigated whether the potential partners can actually complement the rural ICT project, and in the case that they do, an effort should be made to encourage potential partners to participate in the project (Talyarkhan, 2004: 9).

Once partners have been selected to participate, the goals of the project and their defined roles and responsibilities need to be clearly communicated to them. UNDP *et al.* (2001: 29) states that there needs to be coordination and involvement among a wide range of partners through visionary leadership and techniques to support broad-based participation. It is important that the expectations of the partners are the same so that they are not discouraged and frustrated (Bridges, 2006a). A *Memorandum of Understanding* plays a significant role in managing the expectations of partners through communicating clear parameters that define the partners' relationship with the community project (Bridges, 2006a; The World Bank, 2003c: 81; UNDP, 2001b: 17). According to the UNDP (2001b: 17), a Memorandum of Understanding is a quasi-legal document that outlines:

- The scope and guiding principles of the partnership
- Each partner's responsibilities
- Resources
- Activities and expected deliverables
- Expected outcomes and timeframe

Achieving partnership is accomplished through a process of *'negotiating conflicting interest, discovering overlapping interest and mutually beneficial means of achieving individual interest'* (Max Lock Centre, 1999 in Talyarkhan, 2004: 10). The Memorandum of Understanding assists in clarifying and solidifying the partnership.

3.4.17 Choosing the Appropriate or Right Technology

Not all ICT applications are appropriate to every rural environment, and it is important to choose the right applications to implement in a rural project. The project process needs to incorporate mechanisms aimed at selecting the right technology. This can be accomplished through researching the rural environment's existing ICT infrastructure and its compatibility for new ICT, choosing appropriate technology according to the rural needs or context, and innovative applications that can cater for the ICT access and usage constraints faced by rural communities.

The rural environment needs to be analysed in terms of its potential to accommodate particular ICTs. An infrastructure audit should be undertaken to determine what infrastructure exists and the infrastructure requirements necessary to implement an ICT project (IDRC, 2004: 49). For example, aspects of infrastructure that need to be considered so as to plan for realistic measures in case of deficiencies include its availability (hardware and software), accessibility, affordability, security, local electricity supply, cellular/mobile telephone coverage, telecommunication network, Internet service *etc.* (Batchelor and Sugden, 2003; Bridges, 2006b; Talyarkhan, 2004: 8). Other aspects that affect physical access, especially if new technology infrastructure is introduced, include the geographic environment (mountains, deserts), organisational capacities, the policy context of the region, demographic conditions (potential user density), distance from rural users to the main network, and the type of service to be offered (Bridges, 2006b; Dymond and Oestman, 2004: 32; TeleCommons Development Group, 2000: 7).

Innovative ICTs that are introduced should be sensitive to the needs and requirements of the rural community. Bridges (2006b) indicates that the appropriateness of the technology should consider whether it is compatible with how rural people and organisations need and want to put technology to use. Simpler technology that pays attention to infrastructure requirements, especially considering the infrastructure constraints produces more sustainable results (Talyarkhan, 2004: 11; TeleCommons Development Group, 2000: 12; The World Bank, 2003c: 82). ICTs need to be appropriate to the region they are serving, for instance, due to the lack of necessary infrastructure. For example, in an ICT project in Tsilitwa, telephone lines did not exist, but a good cellular telephone coverage was to their advantage, as this resulted in an email system that utilised GSM (Global System for Mobile) communication technology (Conradie *et al.*, 2003: 214).

Once an ICT infrastructure audit and the user requirements have been investigated, particular ICT applications need to be selected. A variety of ICT applications may cater for the constraints

and challenges faced in rural communities. More flexible and innovative applications such as Personal Digital Assistants (PDAs), multifunction mobile phones, and simputers (small low-cost computers) that are more relevant to rural area needs, could be created and introduced (McNamara, 2003: 71). It is important to keep applications simple for basic information requirements, where necessary, rather than using high tech systems (UNDP, 2001b: 10). Dymond and Oestman (2004: 32) illustrate in two dimensions, in Figure 4, the technology most likely to be chosen depending on the distance of the user from the main network, and the potential user density. Obviously other factors also need to be considered. Nevertheless, this diagram displays an idea of the innovative technologies to be chosen in specific rural settings. Figure 4 illustrates that even though fixed line service is still the most often means of Internet access, mobile applications are becoming a more attractive option for Internet access, especially in rural areas. For example, Bangladesh which is one of the least wired countries in the world, leveraged mobile technology through the Grameen Bank's village phone scheme (UNDP, 2001b: 10).

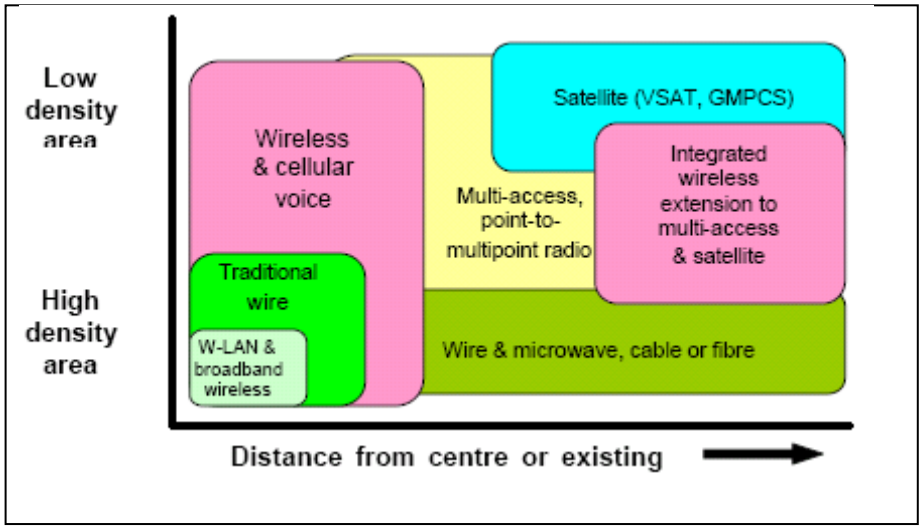

Figure 4: Telecom Technology Niches (Dymond and Oestman, 2004: 32)

Modern technology changes rapidly over time, resulting in new technology standards and products that are introduced into the market. In order to avoid becoming too dependent on costly changes in technology, it is appropriate to adapt technologies based on open standards, applying a technology neutral approach (Bridges, 2006a). Open source applications have therefore been the focus of most ICT-enabled development projects (Ferguson and Ballantyne, 2002: 15; McNamara, 2003: 73; Talyarkhan, 2004: 11, The World Bank, 2003c: 82). The technology neutral approach assists in attaining sustainability, as it allows a project to change or adapt technologies where needed, thereby shifting between technology solutions. Bridges (2006a),

however, highlights that this approach should be practised with careful decision-making, as most experts indicate that technology cannot genuinely be neutral. For instance, the use of open source software can be limited as the expertise involved in adapting the technology to suit rural environments is lacking, in addition to implementation which can be cumbersome and arduous (Ferguson and Ballantyne, 2002: 15).

Costs can also be kept low and ICT services affordable through the use of refurbished computers (Ferguson and Ballantyne, 2002: 16). IDRC (2004: 54) indicates that second-hand computers can be used for demonstration purposes and teaching keyboard skills. However, mechanisms need to be put in place to maintain and upgrade these computers. It is more appropriate to use newer or fasters computers for Internet access and downloading, while keeping most second hand computers for basic ICT services (typing documents) so as to limit technical problems associated with older computers. Furthermore, computers need to be customised to local conditions, as hardware may be prone to environmental conditions of unreliable power supply, temperature and dust (McNamara, 2003: 73). Unless there is a strategy to develop the technical skills of local people, refurbished computers are unlikely to contribute to sustainability, as technical support to maintain these computers is scarce in rural areas (Batchelor and Sugden, 2003; IDRC, 2004: 54; Talyarkhan, 2004: 11).

Even though modern technology may provide more direct advantages to rural communities, traditional ICTs should be considered as complements to existing modern ICTs, in order to be more affordable and accessible to community members. For instance, the community members could make a request on the radio to search for certain information that is available on the Internet.

3.4.18 Building on Existing Public Facilities

The use of existing public facilities in the community is vital for the sustainability of a rural ICT project. According to The World Bank (2003c: 84), it appears to be more efficient for most projects to use existing rather than new buildings. It is also costly and time-consuming to erect a new building, in terms of research, design and the building process involved (Jacobs and Herselman, 2005: 84; Mphahlele and Maepa, 2003: 225). Ideally, a community should support the project through providing a building that is rent and maintenance free. In cases where this is not possible, an organisation (project partner) in the community could provide a space or offer to pay rent as its contribution to the project (Jacobs and Herselman, 2005: 84). The preferred requirements of a building to house the ICTs include electricity, a telephone connection (if no

wireless technology), and security. Jacobs and Herselman (2005: 84) advise that it is more appropriate, where possible, to have a building with separate rooms which can accommodate the expansion of the computer network, and future small business activities that may develop. However, in most cases in rural areas, buildings are limited; therefore the project may have to make do with small single-roomed buildings to accommodate equipment and training sessions (Mphahlele and Maepa, 2003: 225).

When selecting an existing community building, it is also important to consider an appropriate *location* for a telecentre. The visibility and accessibility to as many users as possible in the community is critical to sustainability (Jacobs and Herselman, 2005: 8; Mphahlele and Maepa, 2003: 225). It is advisable to locate a telecentre close to main roads or public places such as shops, schools, and taxi ranks that are easily accessible to both pedestrians and non-pedestrians. In cases where it is not possible to implement the telecentre in a visible place, a marketing strategy that focuses on creating awareness of the project should be devised.

3.4.19 On-going Monitoring and Evaluation of the Project

It is crucial to put into practice the monitoring and evaluation of the rural ICT project process. The lack of monitoring and evaluation is a significant factor that contributes to rural ICT project failure (Dymond and Oestman, 2004: 65; Gerster and Zimmermann, 2003: 49). The UNDP (2001b: 18) explains that it is often a complex and long-term process to understand the impact of ICT on development and social change in the community. Continuous monitoring and evaluation play an important role in keeping the project on track and revealing the impact on the rural community. A plan for monitoring and evaluation needs to be included in planning for the ICT project from the outset.

Monitoring a project aims to check that the project is working toward achieving its goals, such that it positively impacts a community. Monitoring establishes that the project targets have been met and are satisfactory (Dymond and Oestman, 2004: 65). In this case, the aim is to inform stakeholders of the project (community, donors) that the project is heading in the right direction. Furthermore, it acts as an early warning system in the project process to rectify and address any problems incurred in the project before they become difficult to solve (Dymond and Oestman, 2004: 65). The results of monitoring can subsequently enable a project to adapt and tailor ICT services to any changes in demand and circumstance. For example, an FAO ICT project called Futura, was able to determine through monitoring that professional skills development was far more popular than other courses provided in the training sessions, thereby creating a focus for

training (The World Bank, 2003c: 81). It is also advisable to consider best practice characteristics associated with the project as its status is monitored (Jacobs and Herselman, 2005: 78).

The monitoring process should not only commence at the completion of a project, but should be an important focus throughout the life of a project (Talyarkhan, 2004: 9). Appropriate staff need to be selected and trained to monitor and understand the importance of doing so for the smooth running of the project. According to Dymond and Oestman (2004: 65), trained staff should focus on a monitoring function that creates and maintains a system that comprises:

- an up-to-date and reliable database of all the project's facilities and services (service roll-out status, service quality, and usage statistics),
- a pro-active assessment of performance (through a routine combination of field visits, and basic user and project owner interviews),
- a process for filing and resolving of complaints/difficulties and comments

Furthermore, the monitoring process should incorporate regular meetings and discussions (based on project monitoring reports) among donors, project owners and community members regarding the project's progress and impact, and required adaptations (Batchelor and Sugden, 2003; Bridges, 2006a; Dymond and Oestman, 2004: 65). Regular reports that are compiled to show the project process could, for example, consist of the following categories in Table 4, in order to keep a record of project development.

Description of infrastructure/equipment installed and in operation	• Public phones • Internet access points • Etc.
Percent completion	• % of project complete
Services offered & prices charged (broken down by each service offered)	• Telephony • PC training • E-mail • Assisted Internet search • Etc.
Description of users and usage	• Total population covered (e.g. village) • Type of users • Frequency of use • Etc.
Revenue collected	• Broken down by services
Monthly operating costs	• Rent/ building • Salaries • Maintenance/repair • Supplies • Etc.
Financial status	• Profit/loss

Table 4: Project Status Report (Dymond and Oestman, 2004: 66)

The outcome of the monitoring process at regular stages of the project contributes towards project evaluation that has statistical relevance, and provides feedback for the design of other projects.

A critical evaluation of a rural ICT project is a significant part of the project process that varies between different types of projects and usually occurs at both the middle and end of the project (Dymond and Oestman, 2004: 65; TeleCommons Development Group, 2000: 12). It can be approached as an adaptable and iterative learning process that promotes participation among project stakeholders. In view of this, evaluation aims to enable stakeholders to understand the change that has occurred in the community as a result of the project, identify and understand mistakes and shortcomings of the project, improve on past experience, and influence decision-making and project policy formulation (Bridges, 2006a; UNDP, 2001b: 18). The importance of this is that evaluation results can eventually be published and organisations with similar initiatives can then learn from their mistakes, and promote the effectiveness and sustainability of rural ICT projects (Bridges, 2006a; TeleCommons Development Group, 2000: 12).

3.5 Classification of the Critical Success Factors

The critical success factors identified work towards supporting the different categories or types of sustainability. The factors discussed can be classified under the different categories of sustainability that should be developed harmoniously such that ICT as an enabler in rural development can have an effective impact on a rural community. This is shown in Table 5. Some CSFs fall under one category of sustainability but most collaborate to support more than one category of sustainability. On the other hand, CSFs such as ‘simple and clear objectives’, ‘approaching the project in a holistic way’, ‘cultivating an enthusiastic project champion’, and ‘on-going monitoring and evaluation of the project’ support and influence all the categories of sustainability. This relationship across all categories of sustainability may not suggest that the other factors are not as critical but that project managers need to ensure that these factors are taken into consideration by default, regardless of what the objectives of the project may be. Nevertheless, this suggestion is yet to be proven in future research that investigates the weight and influence in comparison of each factor in promoting the sustainability of a rural ICT project. Another interesting observation from Table 5 is how most of the CSFs fall under social and cultural, and institutional categories of sustainability, compared to less significance under economic, political and technological categories.

CATEGORIES OF SUSTAINABILITY / CRITICAL SUCCESS FACTORS	Social and Cultural	Institutional	Economic/Financial	Political	Technological
1. Simple and Clear Project Objectives	*	*	*	*	*
2. Approaching the Project in a Holistic Way	*	*	*	*	*
3. Using ICT to Enhance Existing Rural Development Activities	*	*	*		
4. Cultivating an Enthusiastic Influential Project Champion	*	*	*	*	*
5. Incorporating Socially Excluded Groups	*				
6. Incorporating/Awareness of Specific ICT Policy Influencing the Project		*		*	
7. A Good Understanding of the Local Political Context				*	
8. Significant Participation of Community Target Groups in the Project Process	*	*		*	
9. Focusing on Local/Demand Driven Needs	*	*			
10. Building on Local Information and Knowledge Systems	*				
11. Appropriate Training and Capacity Building		*			
12. Facilitating Local Content Development	*	*			
13. Existing Motivation and Incentive for ICT Job Placement in the Community	*	*	*		
14. Focus on Economic Self-sustainability - Business Development (Entrepreneurship)			*		
15. Encouraged Local Ownership		*			
16. Building Local Partnerships	*	*	*		
17. Choosing the Appropriate or Right Technology	*		*		*
18. Building on Existing Public Facilities	*				
19. On-going Monitoring and Evaluation of the Project	*	*	*	*	*

Table 5: Classification the Critical Success Factors into the Categories of Rural ICT Project Sustainability

3.6 Conclusion

Rural areas are faced with barriers that limit their ability to use ICTs, resulting in projects that fail at different levels, particularly sustainability failure. Sustainability is key for the effective contribution of ICTs to rural development, and for that reason needs to be understood and applied to the rural ICT project process. Categories of sustainability reveal aspects that need to be considered in a project implemented in a rural area. These categories do not work in isolation, but must be developed harmoniously in order to promote overall ICT project sustainability in rural areas. Essentially, there are critical factors of sustainability associated with these categories that need to be incorporated into the rural ICT project process. Therefore, the significance of the development of sustainability implies that the rural ICT project process needs to be receptive to critical factors that play a role in promoting the sustainability of the project.

The critical success factors show that the effective implementation of ICT projects in rural areas rely mostly on human/user (community oriented) factors related to social, political, cultural and economic influences. It is crucial that the project team works closely with the rural community to develop their relationship and trust, and hence become more responsive to these human/user factors. The factors that need to be considered and characteristics of such projects differ significantly from the approach to development of ICT projects in more developed countries or regions. Consequently, an approach toward ICT project management that is sensitive to rural requirements and the critical factors that promote ICT project sustainability needs to be formulated.

Chapter 4

Project Management Practice for Rural ICT Project Sustainability

Chapter Three discussed the concept of ICT project sustainability in rural areas. This chapter explores aspects of ICT project management practice and proposes a model to guide and promote the sustainability of a rural ICT project. The proposed RICT-PLC model which incorporates the practices associated with the CSFs of sustainability, and the traditional phases of a project life cycle is described.

4.1 Introduction

The implementation and management of rural ICT projects requires an approach that is sensitive to rural requirements and the critical success factors that promote ICT project sustainability. The application of appropriate ICT project management practice in a rural environment improves the capability of a project to be sustainable and hence have an effective positive impact on the rural community. The aim of this chapter is to explore aspects of ICT project management practice and propose a model to guide and promote the sustainability of a rural ICT project.

The discipline of project management and the approaches associated with it are explored to set some background for the research. The chapter then indicates and describes the importance of understanding the project's environment, particularly considering the critical success factors associated with promoting sustainability in the environment. The complexity of the environment implies the need for a project to be operated in phases called the project life cycle. Appropriating project management practice for rural ICT project sustainability is therefore examined, adapting the traditional project life cycle to a rural ICT project. The phases of the Rural ICT Project Life Cycle (RICT-PLC) are then explored in terms of the critical success factor practices that should be applied in each phase to promote sustainability. Subsequently the RICT-PLC is briefly reviewed. Finally, the findings are summarised and it is concluded that in order to have a better understanding and application of the life cycle through which rural ICT projects progress, a real-life interpretative case study investigation needs to take place to reveal the approach adopted for implementing and managing existing rural ICT projects toward promoting sustainability.

4.2 Defining Project Management

Development organisations instigate a variety of projects with the aim of achieving strategic development goals within countries. Generally, projects can be defined in terms of their distinctive characteristics and can be summarised as – *"a temporary endeavour undertaken to create a unique product or service"* (Project Management Institute (PMI), 2000: 4). A project is temporary in nature, in that it has a definite beginning and an end. The end of the project will occur either when the project's objectives have been achieved, or when it is clear that the project objectives cannot be met, or the need for the project no longer exists and is terminated. Temporary in this sense does not apply to the product or service that is created by the ICT project. The project has social, economic, and environmental impacts (sustainable impacts) that far outlast the projects themselves, bringing

into context the concept of project sustainability (PMI, 2000: 5). A project is also unique as the product or service it creates is different from any other project or service. For example, in a rural community project, there are needs and constraints specific to a community, which shape the objectives to be achieved in that particular project, and may be significantly different from that of another community.

Project management constitutes the *"application of knowledge, skills, tools, and techniques to project activities to meet project requirements"* (PMI, 2000: 6). It can be considered as a form of management that provides a single point of integrative responsibility toward achieving project objectives effectively/safely under the triple constraint (Association for Project Management Group (APM), 2000: 14; Schwalbe, 2006: 7). The triple constraint is associated with the different ways in which a project is limited by its *scope* (what work will be done), *time* (how long it will take to complete the project), and *cost* (budget to complete the project) goals. A project manager needs to balance, and in some cases make trade-offs between these competing goals in order for a project to be successful. However, other elements, particularly quality, play a significant role in meeting project requirements (Schwalbe, 2006: 8). Quality is a key factor, especially in meeting the requirements of a rural community for instance, as a project may be rejected or not be sustainable where the project implementation has not made an effort to meet local requirements. Therefore some people also refer to the Quadruple Constraint of project management.

In general, a project manager should not only strive to meet scope, time, cost, and quality goals, but importantly *facilitate* the entire process to meet the expectations and needs of the people involved and affected by the project (Schwalbe, 2006: 9). This is known as integration management.

4.2.1 The Project Management Framework

The PMI Project Management Body of Knowledge (PMBOK) provides a structure to explain project management. This structure is called the Project Management Framework as illustrated in Figure 5. The key elements associated with this framework include stakeholders, project management knowledge areas, project management tools and techniques, and the contribution of successful projects to the enterprise.

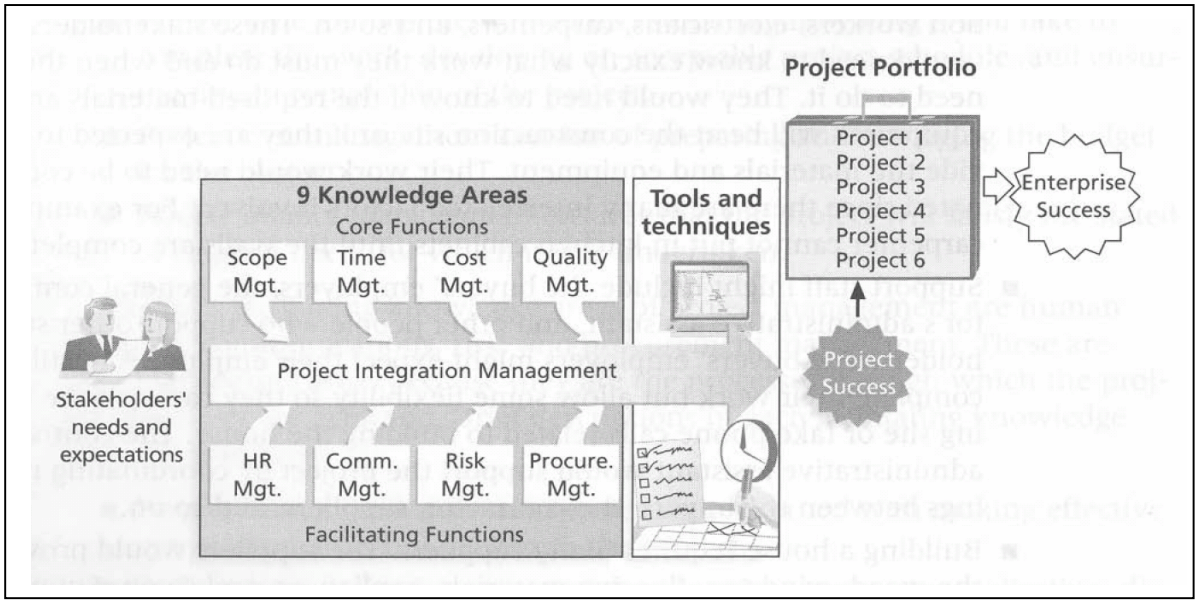

Figure 5: The Project Management Framework (Schwalbe, 2006: 9)

Stakeholders: They include those people who are involved in or affected by the project such as a project sponsor, the project team, rural people, and community leaders. They often have different and sometimes conflicting needs and expectations of the project. These needs and expectations are important through the life of the project, requiring the project manager to develop good relationships with stakeholders to understand their requirements. (Schwalbe, 2006: 10)

Project Management Knowledge Areas: These describe project management knowledge and practice in terms of their component processes (PMI, 2000: 7). There are nine knowledge areas as defined by the PMI, which are categorised as either core knowledge areas or facilitating knowledge areas (Schwalbe, 2006: 11). The core knowledge areas lead to specific project objectives and include project scope, time, cost, and quality management, the quadruple constraint. A brief description of these areas is as follows:

1. *Project Scope Management* involves processes associated with defining and managing all the work which is to be accomplished for the project to be successful. This assists project stakeholders to understand what product or service the project will develop and the processes involved in assisting that development. The main processes involved are scope planning, scope definition, creating a Work Breakdown Structure (WBS), scope verification, and scope control. (Schwalbe, 2006: 169)

2. *Project Time Management* is associated with processes that ensure the timely completion of the project. The main processes involved in attempting to achieve timely completion are project activity definition, activity sequencing, activity resource estimating, activity duration estimating, schedule development, and schedule control. (Schwalbe, 2006: 203)
3. *Project Cost Management* consists of the processes required to ensure the project is completed within the approved budget. A project manager needs to meet stakeholder needs and expectations, while continuously striving to reduce and control project costs. The three main processes involved are cost estimating, cost budgeting, and cost control. (Schwalbe, 2006: 251)
4. *Project Quality Management* involves processes to ensure that the project satisfies the stated or implied needs for which it was undertaken. The main processes are quality planning, quality assurance, and quality control. (Schwalbe, 2006: 293)

The facilitating knowledge areas constitute the processes which assist in achieving the project's objectives, and include human resources, communications, risk, and procurement management.

5. *Project Human Resource Management* involves processes that ensure the effective use of people involved with the project. It includes all project stakeholders, and consists of the processes of human resource planning, acquiring a project team, developing the project team, and managing the project team. (Schwalbe, 2006: 345)
6. *Project Communications Management* involves the timely generation, collection, dissemination, and storage of project information. The four main processes of communication management are communications planning, information distribution, performance reporting, and managing communication among stakeholders. (Schwalbe, 2006: 388)
7. *Project Risk Management* relates to identifying, analyzing, and responding to risks related to the project. The six major processes in risk management are risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, and risk monitoring and control. (Schwalbe, 2006: 429)
8. *Project Procurement Management* constitutes acquiring goods and services from outside the organisation, in order to attain project scope. The major processes are planning purchases and acquisitions, planning contracting, requesting seller responses, selecting sellers, administering the contract, and closing the contract. (Schwalbe, 2006: 471)

9. *Project Integration Management* coordinates all the other management project knowledge areas so that they can work together throughout the project lifecycle to complete a successful project. The seven main processes of project integration management are: develop the project charter, develop the preliminary project scope statement, develop the project management plan, direct and manage project execution, monitor and control the project work, perform integrated change control, and close the project. (Schwalbe, 2006: 471)

Project management is integrative in nature, in that an action or decision in one area usually affects other knowledge areas. The management of these interactions requires that a trade-off be made between the project's scope, time, and cost (the triple constraint), and in some cases the other facilitating knowledge areas. Project management can therefore be viewed as a number of related processes associated with the interactions between knowledge areas, which can be organized into five groups (Figure 6) (PMI, 2000: 30; Schwalbe, 2006: 72):

- *Initiating Processes*: identify and instigate a project or phase. Initiation takes place at each phase of a project life cycle and relates to defining the business need, who will sponsor the project, and who will take role of project manager.
- *Planning Processes*: devising and maintaining project objectives and setting the most appropriate scheme that ensures the project addresses the organisation needs. Project teams often revise project plans during each phase of the project life cycle, in order to account for any changing conditions on the project.
- *Executing Processes*: coordinating people and other resources to carry out the project plan to produce the required project results.
- *Monitoring and Controlling Processes*: regularly measuring and monitoring project progress or performance against the plans, and taking corrective action when necessary.
- *Closing Processes*: formalizing acceptance of the project or phase and efficiently bringing it to an end.

The result or outcome of a process group often becomes the input to another, hence linking the process groups (PMI, 2000: 30). The central process groups, planning, controlling and executing, however, are linked iteratively as illustrated in Figure 6. For instance, 'planning' will provide 'executing' initially with a documented project plan, but will later (as a result of monitoring) provide updates to the documented plan as the project progresses. Furthermore, the process groups

are not discrete one-time events, but instead are overlapping activities that occur throughout the project at varying levels of intensity (Figure 7).

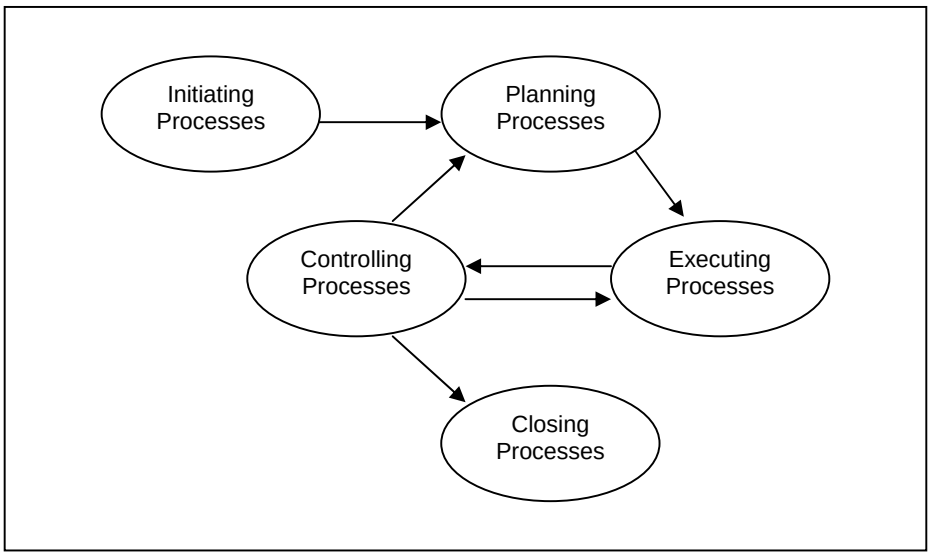

Figure 6: Links among Process Groups in a Phase (PMI, 2000: 31)

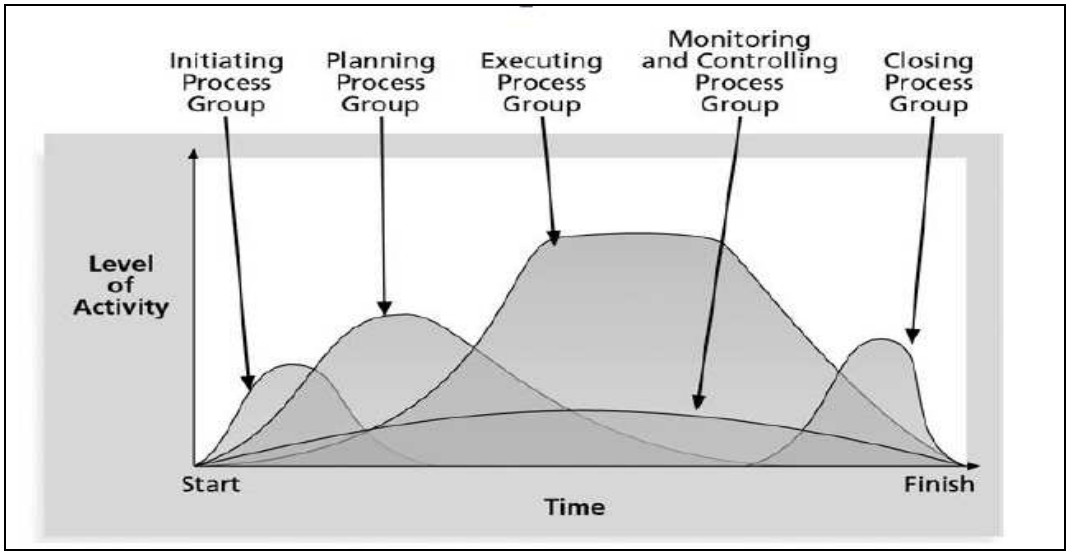

Figure 7: Level of Activity and Overlap of Process Groups Over Time (Schwalbe, 2006: 73)

The main activities of each process group can be mapped to the nine project management knowledge areas. Appendix C displays the 44 project management activities, the process groups in which they are distinctively completed, and the knowledge areas in which they feature.

Project Management Tools and Techniques: assist project managers and teams in carrying out the processes associated with the nine knowledge areas. For example, Gantt charts and project network diagrams are popular tools and techniques used for time management.

The PMBOK Project Management Framework, which was developed and is the standard approach in the United States (US), is just one of the structured approaches to managing projects devised by the Project Management Institute. Nevertheless, it is important to be aware of other approaches to project management, and their possible application to the rural context. One other common structured approach that has become the standard for the United Kingdom (UK) is the PRINCE2 (Project in Controlled Environment) project management approach.

The Contribution of Successful Projects to Project Management Base: Many projects contribute to the project management knowledge base, especially through lessons that have been learned from successful or sustainable projects. Their vital contribution can assist in improving the theory and practice of project management. An example is the 2001 Standish Group study that reveals factors, called the CHAOS Ten (revised) that significantly contribute to the success of a project. Each factor has been weighted according to its influence on the project's success, with higher points indicating lower project risk, as displayed in Table 6 (The Standish Group International, 2001: 4). A project may not require all factors in order to be successful, however, the more the factors are present in the project's strategy, the higher the level of confidence. The first CHAOS Ten were introduced in the 1994 study, with user involvement having highest weighting, followed by executive support (The Standish Group International, 1994: 5). The latest report (2001), however, indicates executive support as having the highest weighting, which is then followed by user involvement. This does not necessarily mean user involvement is now less important in projects, but instead that executive support significantly influences some of the other factors, such as having an experienced project manager, providing clear business objectives, using standard software infrastructure, and adapting a formal methodology (Schwalbe, 2006: 14; The Standish Group International, 2001: 4). Good project scope and time management are related to the other factors of applying firm basic requirements, minimizing scope, and achieving reliable estimates.

The relative importance of the revised CHAOS ten factors may vary among different types of projects, and countries, especially in relation to their diverse culture compared to the U.S.A. For

example, a 2004 survey in China discovered that relationship management was viewed as a top success factor for information systems, whereas in the U.S.A it is not mentioned as a significant factor (Schwalbe, 2006: 15).

	The CHAOS Ten Factors	Weight
1.	Executive Support	18
2.	User Involvement	16
3.	Experienced Project Management	14
4.	Clear Business Objectives	12
5.	Minimized Scope	10
6.	Standard Software Infrastructure	8
7.	Firm Basic Requirements	6
8.	Formal Methodology	6
9.	Reliable Estimates	5
10.	Other	5

Table 6: The Revised CHAOS Ten (The Standish Group International, 2001: 4)

The critical success factors (CSFs) for rural ICT project sustainability identified in Chapter 3 relate to some of the CHAOS Ten of the 2001 report. The importance of each factor in rural ICT project environments may, however, differ from those of more established information systems organisations (in more developed regions) on which the Standish group survey focused. This is shown by the proposed link in Table 7 where only five of the CHAOS Ten can relate to the identified CSFs for rural ICT project sustainability. Nevertheless, a comparison between these two types of information technology environments can still be made, and a proposed illustration of the link between the critical success factors of rural ICT project sustainability and the CHAOS Ten is shown in Table 7. This linkage indicates the importance of applying appropriate project management practice that is sensitive to these factors to promote the success or sustainability of the rural ICT projects. In Table 7, it is notable that most of the CSFs relate to the CHAOS Ten factor 'user involvement', which signifies the need to focus on community involvement in rural projects, as the environment is reasonably community-oriented. Furthermore, the focus on user involvement does not necessarily mean rural ICT projects concentrate on this factor, but that this factor has

increased complexity and can be broken down into further factors related to user involvement that are specific to rural projects.

CHAOS Ten Factor	Critical Success Factors for Rural ICT Project Sustainability
1. Executive Support (relate to political leadership in the community)	• A Good Understanding of the Local Political Context
2. User Involvement	• Cultivating an Enthusiastic Influential Project Champion • Incorporating Socially Excluded Groups • Significant Participation of Community Target Groups in the Project Process • Facilitating Local Content Development • Appropriate Training and Capacity Building • Building Local Partnerships
3. Experienced Project Management	–
4. Clear Business Objectives	• Simple and Clear Project Objectives
5. Minimized Scope	• Building Local Partnerships
6. Standard Software Infrastructure	–
7. Firm Basic Requirements	• Focusing on Local/Demand Driven Needs • Building on Local Information and Knowledge Systems
8. Formal Methodology	• On-going Monitoring and Evaluation of the Project
9. Reliable Estimates	–
10. Other	–

Table 7: Comparison of the CHAOS Ten and Critical Success Factors for Rural ICT Project Sustainability

4.2.2 The PRINCE2 Project Management Approach

The original version of PRINCE was developed by the Central Computer and Telecommunications Agency (CCTA) in 1989 for IT based projects, and has now become a *de facto* standard for project management in the UK (McManus and Wood-Harper, 2003: 136). Subsequently, the PRINCE2 version was introduced, which was designed to incorporate the requirements of users and enhance a method toward a generic best practice project management approach for different types of projects. PRINCE2 focuses on a process-based approach to project management where a process is defined with its key inputs and outputs together with the objectives and activities to be carried out (McManus and Wood-Harper, 2003: 137). According to the APM Group (2006), PRINCE2 is structured around:

- An organised and controlled start, that is, appropriate planning before the project is undertaken
- An organised and controlled middle, which ensures a project is continuously organised and controlled
- An organised and controlled end or completion of the project

A project is divided into manageable stages so that resources can be controlled efficiently with regular progress monitoring throughout the project. The PRINCE2 approach is driven by the Business Case, or in the case of a rural community, the Community Case. This takes into consideration the community's justification, commitment and rationale for the project's deliverables or outcome (McManus and Wood-Harper, 2003: 137). This case is regularly reviewed together with the project's progress to ensure that the needs and objectives of the community, which are prone to change, are still being met.

The processes in the PRINCE2 approach include starting a project, directing a project, and planning and managing. The components associated with these processes are (McManus and Wood-Harper, 2003: 138):

1. **Organisation**: based on a customer/supplier environment where a customer wants a service or product which the supplier provides. There are three key roles that combine to form the project board. These are the senior user and executive who make up the customer (user) organisation, and the senior supplier (representing the supplier organisation). The project board is continually updated on the progress of the project, together with project assurance which provides independent assurance to the board. The PRINCE2 approach emphasizes committed user and customer personnel involvement.
2. **Planning**: There are two important aspects of planning, that is, Project and Stage Plans, and Product-based Planning. The project plan identifies the ultimate goals, the stage plan shows in detail each stage in turn, and the product-based plan considers the outcome (products) of tasks within the project. An exception plan will also be drawn up where forecasts show that the project may exceed its tolerance.
3. **Controls**: reviewing and assessing the project from initiation to closure to ensure the project is being delivered as planned.
4. **Stages**: each project is divided into a number of decision points which define stages. The initiation stage is mandatory, but other stages that best suit the project are later chosen.

5. **Risk Management**: In PRINCE2, an effort is made to manage business risks and project risks. Business risks are where the resulting project or service may not deliver the intended benefit. Project risks occur when the project's ability to deliver on time and within budget is threatened.
6. **Quality in a project environment**: monitoring all aspects of the project's performance and products/services to ensure the project satisfies the needs and objectives of the community.
7. **Configuration management**: As PRINCE2 is associated with a central theme of product-based planning, there needs to be the proper management of products through version control and change. Products are classified as *management* (created for the purpose of running the project, like reports), *quality* (standards and quality criteria) and *specialist* (designed to deliver the benefit to be used by the end-user).
8. **Change Control**: in the case of an exception reported on a particular stage, the project manager needs to be prepared with detailed plans for that stage that are subject to strict change control. Change control is linked to configuration management through specialist products, where request for a change requires a modification to a product, or when a product is incorrect and does not meet the need.

The PRINCE2 methodology defines specific responsibilities for key project participants which include the project steering committee, users, project managers, systems analysts, programmers, quality control specialists, and the contract managers. Figure 8 displays the structure of PRINCE2, together with the roles of participants, and the range of documents produced over the project life cycle (McManus and Wood-Harper, 2003: 144).

The PRINCE2 approach and PMBOK Project Management Framework are often viewed as two separate approaches to project management. However, a case study of Getronics done by the APM Group views the PMBOK Project Management Framework and the PRINCE2 methodology as complementary in nature, and not necessarily alternative methods of project management (APM Group, 2003: 6). PMBOK is seen as a combination of generally accepted project management knowledge and principles that provide a rich reference (encyclopaedic source of information) in practice. PRINCE2, on the other hand, is a process-based project management method that describes in detail the different activities to perform. Therefore PRINCE2 and PMBOK can be combined through: *"the application of PRINCE2 processes and in the use of the PMBOK® knowledge areas as reference material augmented by the PRINCE2 components"* (APM Group,

2003: 8). There appears to be a great deal of agreement between the two methods, considering the aspects that are emphasized (Eastoe, 2006).

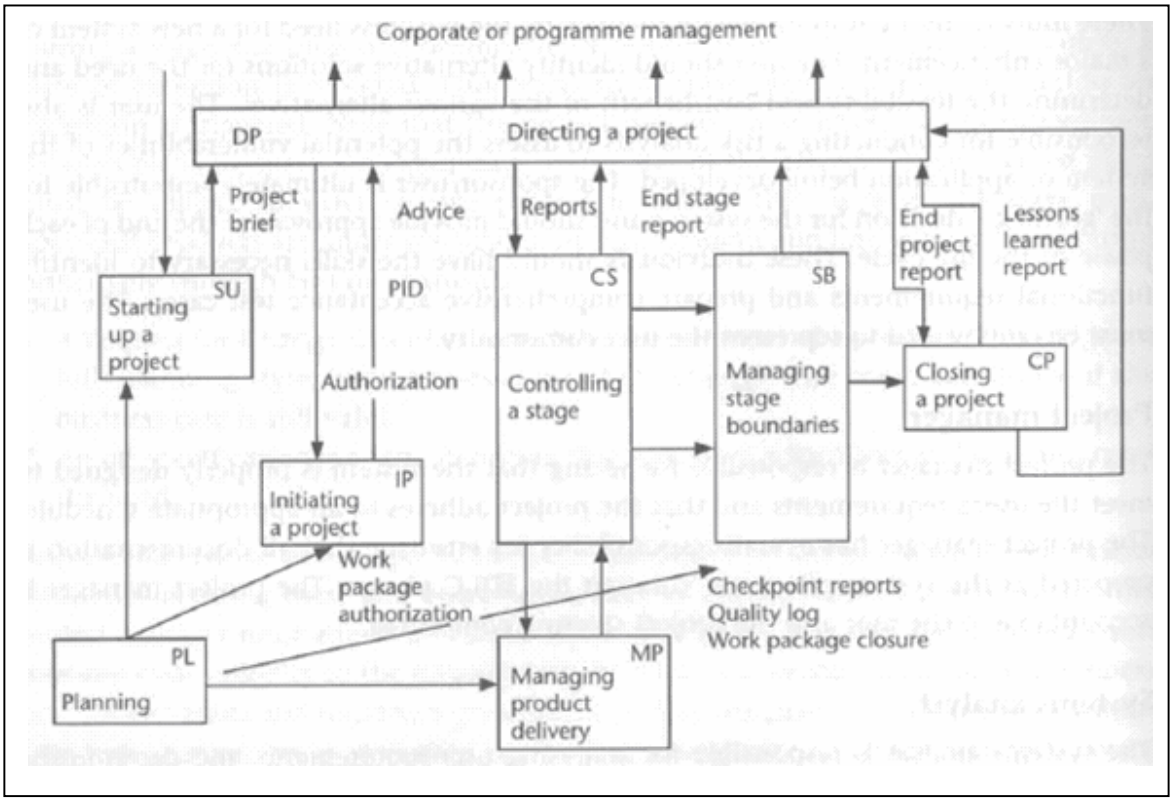

Figure 8: PRINCE Structure (McManus and Wood-Harper, 2003: 144)

4.3 The Project's Environment

An ICT project cannot operate in isolation from its environment, but is significantly influenced by and simultaneously influences the characteristics of the micro and macro environment in which it is implemented (APM, 2000: 16; PMI, 2000: 14; Saad, Cicmil and Greenwood, 2002: 623; Schwalbe, 2006: 40). Each project is unique to its environment, which comprises both the internal and external environment such as cultural, social, political, economic, regulatory, and ecological. A project team needs to understand the environment in which the project is implemented such that appropriate mechanisms can be shaped to promote the success and sustainability of the project. In the case of this research study, the project team needs to understand the rural environment and the factors that influence the project's objectives.

It can be inferred from Schwalbe (2006: 40) that in order for a project to truly meet the needs of the community, it should be viewed holistically and understood in the greater rural community context. The systems approach to project management describes this holistic view of a rural ICT project

using systems philosophy, systems analysis, and systems management. A systems philosophy is an overall model that assists in understanding how an ICT project can relate to the whole rural community to fulfil some purpose. Systems analysis uses a problem solving approach to define the project scope, divide it into components, and then identify and evaluate its problems, opportunities, constraints and needs. Lastly, the systems management approach would consider the key business, technological and organisational issues relating to the rural ICT project life cycle, so as to identify and satisfy key stakeholders and do what is best for the whole community (Schwalbe, 2006: 41). In the case of a rural community, these three aspects of systems management can be viewed as *economic, technological* and *rural society* issues respectively:

- **Economic** issues relate to the production, management, and use of resources in the rural community, especially considering rural development, to meet their livelihood needs effectively. Possible questions that are asked regarding economic issues include: who will sponsor the project? How much will it cost the community? What will the economic impact be on rural livelihood activities?
- **Technological** issues relate to the choice in technology in a particular rural environment. Appropriate technology should be chosen, which supports the specific rural ICT project and alleviates the factors that influence its implementation negatively. Typical questions that can be asked regarding technological issues include: What ICT application modes will be used, for example, wireless? How will the rural infrastructure affect Internet access? Will there be open source software development or deployment?
- **Rural Society** issues relate to social, cultural and political issues that shape a rural community. These are normally soft, people-related issues that significantly influence a rural ICT project. Possible questions that are asked regarding rural society issues include: Who in the community will be directly affected by the project? Which target groups will represent the community in the project? What training and capacity building will take place? What political influence exists?

Most narrowly-focused projects tend to concentrate on the technological issues of a rural ICT project, particularly on cutting edge technology that can be implemented in rural areas which often lack certain infrastructural requirements (electricity, telecommunication networks and geographical constraints). However, the rural environment is complex, and more significantly affected by economic and rural society issues. If these issues are ignored or taken for granted in a rural ICT project, the ability of the project to be successful or sustainable will be limited. Project managers

therefore need to consider all these issues holistically and keep in mind the specific interests and needs of the rural community in relation to the capability and sustainability of the technology. The holistic systems management approach for rural ICT project sustainability is illustrated by adapting Schwalbe's (2006: 41) Three-Sphere Model for Systems Management. Figure 9 incorporates the categories of sustainability discussed in Chapter 3 (social, cultural, institutional, economic, political, and technological sustainability), which consider critical success factors that are necessary to deal with and manage the issues that characterise rural environments.

As economic and rural society issues combined with the categories of sustainability are integrated into project planning (instead of unduly focusing on technology issues), projects can be viewed as a series of inter-related phases that promote project sustainability in a complex rural environment. Schwalbe (2006: 53) suggests that because projects operate in a system and entail uncertainty, it is good practice to divide the project into several phases. These phases make up the Project Life Cycle.

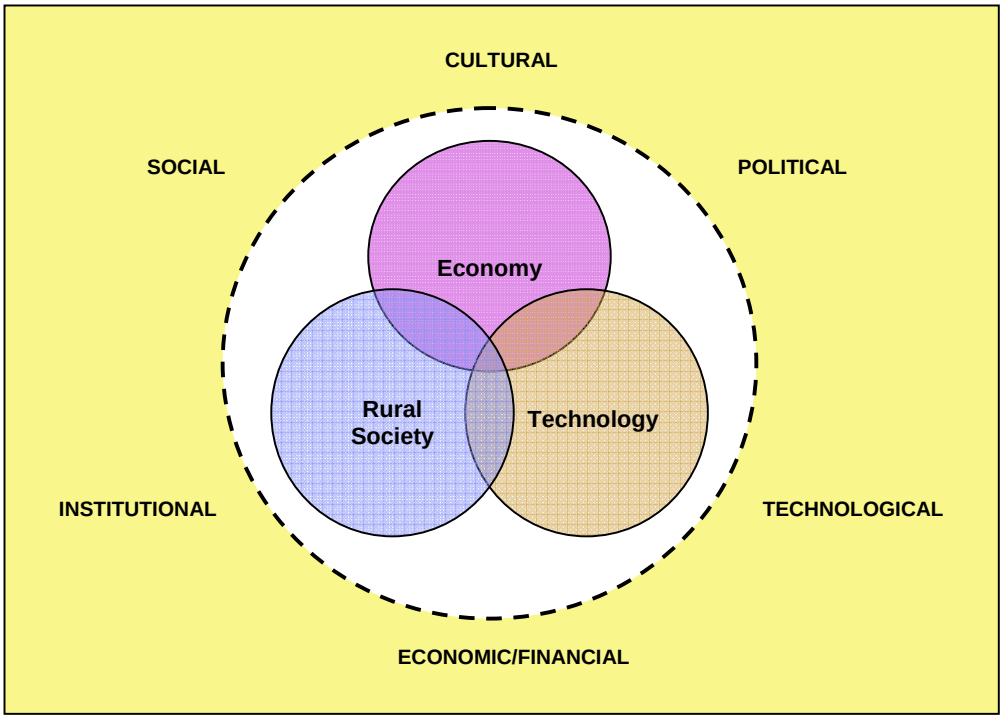

Figure 9: The adapted Three-Sphere Model incorporating the Categories of Rural ICT Project Sustainability

4.3.1 The Project Life Cycle

The project life cycle is essentially a collection of phases in a project. Project life cycles in general, define (Schwalbe, 2006: 53):

> *"…what work will be performed in each phase, what deliverable will be produced and when, who is involved in each phase, and how management will control and approve work produced in each phase."*

A project life cycle is designed to define the beginning and the end of a project with each phase marked by the completion of a verifiable work product: a deliverable (McManus and Wood-Harper, 2003: 25; PMI, 2000: 12). A *deliverable* in this case refers to a product or service, such as a report, training session, feasibility study, or elicited requirements that are produced or provided as part of a project. The level of resource needs and uncertainty of the project varies as the project progresses with time (Schwalbe, 2006: 53). The early phases of the project life cycle are characterised by low resource needs and a high level of uncertainty where project managers have a greater opportunity to influence the project's final product/service characteristics. Subsequently, more resources are needed and the certainty of the project improves during the middle phases of the cycle. The final phases concentrate on ensuring the project requirements are met and the completion of the project is approved by the project sponsor.

The general theoretical phases that traditionally make up the project life cycle are often referred to as Concept, Development, Implementation and Close-out (Labuschagne and Brent, 2005: 162; Schwalbe, 2006: 54). The first two phases (concept and development) are collectively known as *Project Feasibility*, and focus on the planning of the project, whereas the last two (implementation and close-out) that focus on delivering the actual project work are referred to as *Project Acquisition* (Figure 10) (Kerzner, 2003: 69; Maylor, 2003: 28; Method123, 2006; Schwalbe, 2006: 54):

1st. **Concept**: includes activities that describe the project using high level or summary plans which define the need for the project and its underlying concepts, and may include activities to initiate the project. It is determined at this stage what the project is all about, the reason for and intentions of its existence as it progresses. A preliminary evaluation of a project idea is undertaken. Therefore, project possibilities and alternatives to problems are explored. Most importantly, there is a preliminary analysis of the risk and resulting impact on time, cost, and performance requirements in addition to the potential impact on community resources. Sample deliverables of this phase

include the creation of a business case, undertaking of a feasibility study, preliminary cost estimate, a high level work breakdown structure (WBS) for project scope, the appointment of a project team, and the establishment of a project office. Fundamental questions: What is to be done? Why is it to be done?

2nd. **Development**: proceeds after the concept phase and is associated with more detailed project plans, a more accurate cost estimate, and a more thorough WBS. Elements of the conceptual phase are refined together with a firm identification of the resources required. The purpose of these plans is to clearly identify all project phases, activities and tasks, and allocate adequate resources and finances to the project. Fundamental questions: How will it be done? Who will be involved in each part? When can it start and finish?

3rd. **Implementation**: Each activity and task listed in the project plan is executed in this phase. Sample deliverables of this phase include the creation of a definitive or very accurate cost estimate, required work is delivered, and performance reports are provided to stakeholders. Additionally, a series of project management processes take place to monitor and control the deliverables of the project. The process, for instance, includes the monitoring and control of project time, cost, quality, change, risks, issues, procurement, customer acceptance, and communications. The bulk of the project team's effort is spent in this phase. Fundamental question: How should the project be managed on a day-to-day basis?

4th. **Close-out**: All project work is completed and there should be customer acceptance. This phase therefore involves *"releasing final deliverables to the customer, handing over project documentation, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders"* (Method123, 2006). It is also advised to undertake a post implementation review to quantify overall project success and document project experiences and lessons learned for future projects. This provides a significant input to the performance of subsequent projects. Fundamental question: How can the process be continually improved?

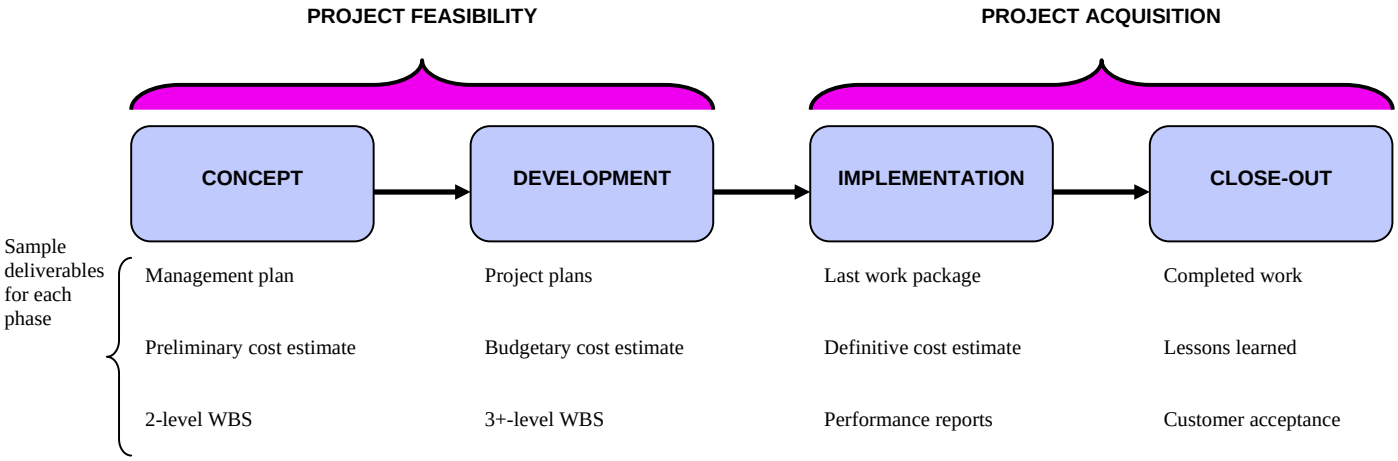

Figure 10: Phases of the Traditional Project Life Cycle (Schwalbe, 2006: 55)

The project life cycle establishes a desired level of management control and links the on-going operations of the organisation appropriately (McManus and Wood-Harper, 2003: 25; PMI, 2000: 12; Schwalbe, 2006: 54). Each phase of the project needs to be completed before moving onto the next stage. According to the PMI (2000: 11) the conclusion of each phase of the project life cycle is associated with a review of deliverables and project performance thus far. This helps to determine if the project should continue into its next phase, and also detects and corrects errors efficiently. Before moving onto the next phase, deliverables of the previous phase are usually approved. However, in some cases a subsequent phase may begin prior to the approval of the previous phase. This overlapping of phases is referred to as *fast tracking*, and usually occurs when the risks involved are deemed to be acceptable.

The number of phases in a project life cycle can vary between industries or different types of projects because of the complex nature and diversity of projects, where most have four or more, while some have nine or more phases (Kerzner, 2003: 69; McManus and Wood-Harper, 2003: 25; PMI, 2000: 13; Schwalbe, 2006: 56;). Labuschagne and Brent (2005: 162) name some project life cycle approaches as control-oriented models, quality-oriented models, risk-oriented models, as well as those specific to a company. Table 8 summarises seven proposed generic life cycle phases in a project (Labuschagne and Brent, 2005: 163). This generic project life cycle may be tailored to suit a particular project, and in some cases, phases may also be combined. Regardless of the specific phases of the project life cycle, it is good practice to realise that projects have phases that connect

the beginning to the end of the project, and hence provide a measure of the project's progress towards achieving its goals (Schwalbe, 2006: 56).

Phase names	Alternative names	Description of phase
Idea generation	Proposal Concept Initiation Ideation	In this phase the idea for a new project is generated and the initial proposal that describes the business need must be prepared. This phase does not require a formal project plan
Pre-feasibility	Initial investigation Initial assessment Preliminary investigation Evaluation Research	The goal of this phase is to evaluate the existing proposal in terms of financial, operational and technical viability as well as against the company's strategy. Overlapping or synergy with other projects should also be checked out
Feasibility	Detailed investigation Definition Business case Evaluation Authorization	The optimum solution to address the business need must be identified and defined. All areas of this solution must be analyzed and assessed to determine killer concerns and risks
Development and execution	Implementation Realization Production Construction Build Develop and test	This phase involves design, development, creation and building of the chosen solution. The supporting system, manuals, business processes and training for the solution must also be developed during this phase
Commissioning	Trial Beta test Validation	In this phase the solution is tested in an operational environment. The purpose is to validate the acceptance and capabilities of the solution
Launch	Release Completion Implementation Handover Acceptance	The project is handed over to the business units and thus released to the operational environment during this phase. This phase also marks the beginning of operational support
Post Implementation Review (PIR)	Business review Project audit Post project review	After sufficient time (9–15 months) the project should be assessed to determine if the benefits were delivered and what the impact of the project was on the business. Lessons learned should be captured for future reference

Table 8: Life Cycle Phases in a Project (Labuschagne and Brent, 2005: 163)

As projects follow a life cycle, so do products (Schwalbe, 2006: 56). It is also important to understand the phases of products for good project management. The difference between the project and product lifecycle lies in the fact that the product life cycle differs for each product. The project life cycle on the other hand remains the same, regardless of the specific product being produced. Software development projects for example, are associated with a systems development lifecycle (SDLC) that describes the phases involved in developing information systems. According to Schwalbe (2006: 57), the development of software requires that project managers modify traditional project management methods, depending on the particular product's lifecycle. Systems

development lifecycle models could therefore be predictive or adaptive. The models are described as follows (Schwalbe, 2006: 57):

- The **Predictive Life Cycle** clearly articulates the scope, and accurately predicts the schedule and cost of the project. A large portion of the project effort is spent attempting to clarify the actual requirements of the entire system and is followed by the design of the system. Often, the users are unable to experience any tangible results of the software for a comprehensive period of time. Examples of predictive models in the systems development life cycle (SDLC) include the waterfall life cycle, spiral life cycle, incremental build life cycle, and the rapid application development (RAD) life cycle.
- The **Adaptive Software Development (ASD) (or Agile Software Development) life cycle**, on the other hand, assumes an adaptive approach for the development of the software as the requirements cannot be clearly articulated in the early stages of the project. Projects that use this approach tend to be mission driven and component based, use time-based cycles to meet target dates, develop requirements using an iterative approach, practice risk driven development, and are change tolerant in addressing and incorporating risks rather than mitigating them. Two common examples of the ASD life cycle include Extreme Programming (XP) and Scrum.

Some authors question the rules and guidelines set traditionally for information systems projects. Table 9 shows the difference between privileged and marginalised methodological systems development processes proposed by Abrahamsson, Salo, Ronkainen, and Warsta (2002: 9). Privileged methods tend to use commonly accepted processes (known as plan-driven traditional systems development), while marginalised methods are associated with adaptive software development methods that are flexible and adapt to the changing project environment.

Process oriented systems development is commonly characterised by the initial development of requirements that remain frozen and completely locked before design and implementation take place (McCauley, 2001 in Abrahamsson *et al.*, 2002: 10). This approach is not always feasible and hence there is a need for a more flexible and adaptable approach which allows for late changes in requirement specifications. The adaptive software development approach therefore aims to be flexible through practicing how to handle changes originating from the environment, throughout the project's life cycle.

Privileged Methodological Text	**Marginalised Methodological Text**
Information systems development is:	
A managed, controlled process	Random, opportunistic process driven by accident
A linear, sequential process	Processes are simultaneous, overlapping and there are gaps between
A replicable, universal process	Occurs in completely unique and idiographic forms
A rational, determined, and goal driven process	Negotiated, compromised, and capricious

Table 9: Some Differences of the Privileged and Marginalised Methodological Information Systems Development Processes (Abrahamsson, Salo, Ronkainen and Warsta, 2002: 9)

The phases of a rural ICT project life cycle may vary significantly from the traditional project life cycle that was initially developed for different industry environments. Nevertheless, rural ICT projects could still learn and adopt approaches used in industry, to deal with the complexities of the rural environment. Project management that is sensitive to the rural environment should be practiced appropriately in each phase of the project life cycle.

4. 4 Appropriating Project Life Cycle Practice for Rural ICT Project Sustainability

Project management that is appropriate to the rural environment needs to be practised in order to promote ICT project sustainability. The implementation of an ICT project in rural areas may naturally apply project management knowledge, whether from the PMI PMBOK guide or the PRINCE2 approach. However, it is important that the approach to project management is receptive to the concept of sustainability, such that an ICT project may contribute significantly to rural development activities. Therefore, sustainability should be considered in every aspect of project management, including every stage of the project life cycle.

An important aspect of a rural ICT project is that the project should meet the local needs of the community, and the appropriate mechanisms which consider critical success factors for promoting sustainability should be applied. A rural ICT project should produce quality products or services that specifically satisfy the stated or implied rural requirements such that it does not compromise future users or generations from benefiting from the project's impact. A project team therefore needs to develop a good working relationship with key stakeholders in the community to understand

what their stated or implied needs are (Schwalbe, 2006: 293). The extent to which appropriate project practices that consider the critical success factors of rural ICT project sustainability are applied may reveal the potential of a project for sustainability in a rural area.

The nature of project management has changed since the 1960s, with most projects in the new millennium adopting a far more informal approach characterised for instance, by less paper work and the reliance on techniques such as checklists for end-of-phase reviews (Labuschagne and Brent, 2005: 161). A formal approach may have been taken for granted in the implementation and management of a rural ICT project, thereby jeopardizing the success and sustainability of the project. Rural ICT projects may have adopted the project life cycle to guide the operation and management of the project; however, there are key aspects of the project that need to be considered. These kinds of rural ICT projects differ significantly from projects in industry, particularly with regard to the complex rural environment (Figure 9) in which they are implemented. Rural ICT projects are confronted with barriers and challenges to ICT use in communities, hence threatening the success or sustainability of projects. Viewing rural ICT projects only in the confines of PMI or PRINCE2 project management is too narrow an approach for developing countries (Saad *et al.*, 2002: 618). Project management across the project life cycle needs to be strongly associated with practices that contribute toward ICT project sustainability.

This research has identified that there are critical factors that need to be considered when implementing ICT projects in rural communities. These critical success factors aim to alleviate and limit the influence of the challenges associated with ICT use in rural communities. The phases across the rural ICT project life cycle need to encapsulate the critical success factors of sustainability that are sensitive to the complex rural environment. Rural ICT projects need to build a set of guidelines in relation to the implementation of projects that incorporates the CSFs of sustainability. Each critical success factor is associated with practices that can be applied to the four phases of the traditional project lifecycle, hence creating a Rural ICT Project Life Cycle that promotes sustainability in the rural community.

4.4.1 Proposed Phases of the Rural ICT Project Life Cycle

The proposed Rural ICT Project Life Cycle (RICT-PLC) is initially adapted from the traditional project life cycle. As mentioned earlier, the number of phases in a project life cycle vary between industries or different types of projects because of the complex nature and diversity of projects. An

initial proposal of the RICT-PLC model therefore adapts the simplistic traditional project life cycle phases in the preliminary development of the model. The traditional project life cycle has been applied in a variety of industries, but eventually appropriated to the industry context. A further real-life investigation of rural ICT projects may reveal the actual phases typical of rural ICT projects. Nevertheless, an important aspect to consider for promoting the sustainability of a rural ICT project once it has been handed over to the community is to undertake a post implementation review through continuous monitoring and evaluation of the project (Labuschagne and Brent, 2005: 163). This phase confirms the impact and benefits of the project over a period of time, after project close-out. Therefore, the phases of the preliminary proposed RICT-PLC model consist of Concept, Development, Implementation, Close-out, and Post Implementation Review, where the processes that fall under these phases are naturally applied to a rural ICT project (Figure 11).

The practices that relate to the CSFs of sustainability need to be incorporated into the relevant phases of the rural ICT project life cycle in order to promote the sustainability of the project. Some CSFs practices are also associated with the nine knowledge areas of project management developed for the PMI PMBOK guide, which describes project management knowledge and practice in terms of their component processes, and processes in the PRINCE2 approach (McManus and Wood-Harper, 2003: 138; PMI, 2000: 7). Figure 11 identifies the specific critical success factors (according to CSF section number in Chapter 3) that fall under each phase of the RICT-PLC. The CSF practices associated with each phase produce deliverables as the project progresses. Although each phase produces standard project management sample deliverables, there are also sample deliverables specific to a rural ICT project. These sample deliverables include a rural feasibility report, rural requirements report, training structure, regular monitoring reports, rural community acceptance, stakeholder maintenance agreement, lessons learned, and post implementation review report. Within the context of a rural ICT project, the CSF practices that fall under each phase of the proposed RICT-PLC are discussed:

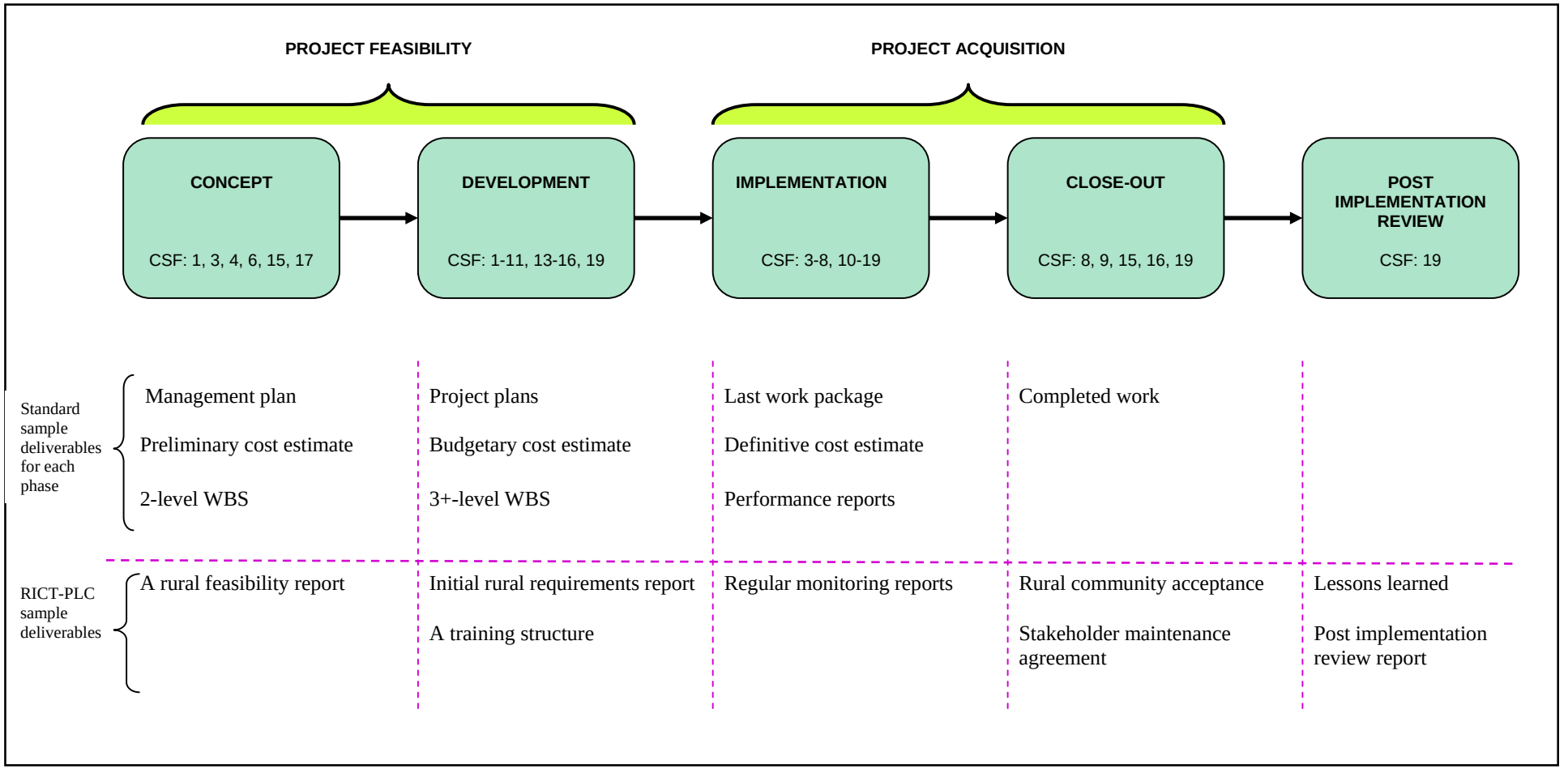

Figure 11: The Proposed Rural ICT Project Life Cycle (RICT-PLC)

4.4.1.1 Concept

This stage describes an initial proposal of the need for the project in the rural community. A high level plan for the rural ICT project is developed to define this need for the project and its underling concepts for supporting rural development activities. Ideas for the ICT project are recorded in a brainstorming session among the project team and community members, where problems and potential solutions are identified and defined (Kerzner, 2003: 383). In addition, a feasibility study is embarked on to evaluate the viability of the project (alternative conceptual solutions, and benefits and costs of the project), particularly with regard to supporting rural development activities in the community. The involvement of community members is critical in the feasibility study, as they provide much of the required effort and information, and are able to judge the impact of alternative approaches to the project. The CSF practices that should be incorporated in this phase include:

- *C1. Simple and clear project objectives*
  - Set simple and clear objectives that are not too lofty to support project awareness
  - Develop clear and simple project objectives that are sensitive to the social and cultural, political, economic, institutional context of the community
- *C3. Using ICT to enhance existing rural development activities*
  - Identify rural livelihood activities that contribute to rural development in the community to identify the need for the project. For example, crafts and arts or cultural practice potentially promote tourism
- *C4. Cultivating an enthusiastic influential project champion*
  - Select project champions who have strong local social networks and are familiar with the rural environment to develop awareness and belief in the project objectives among the project team and community
  - Select a local project champion to inspire, drive, guide, and encourage the targeted community to integrate ICTs into rural development activities
  - Select a project champion that can represent a critical social group. For example, there should be a female project champion to encourage women in the community to participate in the ICT project
- *C6. Incorporating/Awareness of specific ICT policy influencing the project*
  - Research the ICT policy environment, especially considering policy that affects the rural ICT project both directly and indirectly

- *C15. Encourage local ownership*
  - Stimulate ownership from the start or include it as part of the inception phase to strengthen local creative communities to own project processes and results. Ownership should be *taken* and not *given*.
- *C17. Choosing the appropriate or right technology*
  - Research the rural environment's existing ICT infrastructure and its compatibility for new ICT (conduct an infrastructure audit)

4.4.1.2 Development

This phase identifies project stages, activities and milestones (including the relationship between the tasks), and plans to allocate adequate resources and finances to the rural ICT project. The phase is particularly significant in relation to planning for the introduction and integration of the new technology into the rural community. A more defined local need for the project and the risks relating to the implementation of the project are also identified through an analysis and assessment of local requirements. The CSF practices that should be incorporated into this phase include:

- *C1. Simple and clear project objectives*
  - Hold regular meetings with the community to keep them informed about the project progress with regard to meeting objectives
  - Plan realistically in accordance with objectives
  - Set appropriate timeframes for realistic deliverables for each phase of the project, taking into account the constraints regarding ICT use in rural areas
  - Delegate and communicate the accountability for deliverables to stakeholders of the project (including the community) such that it is clear who is responsible for completing project tasks and activities within a given period of time
- *C2. Approaching the project in a holistic way*
  - Adopt a coordinated, strategic and holistic approach to the project, considering how the project can relate to the rural community at large. Especially consider the interests and needs of the community in relation to *economic, technological* and *rural society* issues (Figure 9).
- *C3. Using ICT to enhance existing rural development activities*
  - Identify existing rural development organisations or projects in the rural community that could adopt ICTs to support rural development activities

- *C4. Cultivating an enthusiastic influential project champion*
  - Involve the project champions significantly in project planning and final decisions for community integration
- *C5. Incorporating socially excluded groups*
  - Identify and incorporate social cultural factors (in planning) that cause particular social groups to self-exclude themselves from the project in the rural community. This enables the understanding and awareness of power dynamics and politics around discrimination.
  - Include women and youth from the community in project planning to effectively determine barriers and encourage involvement.
- *C6. Incorporating/Awareness of specific ICT policy influencing the project*
  - Plan to enhance or mitigate the influence of ICT policies on the sustainability of the project
- *C7. A good understanding of the local political context*
  - Research the local political context and influence in the community, also considering the local policy environment affecting ICT use
  - Identify local elites, their factions and interests in the community
  - Encourage participation of local political gatekeepers to create awareness and understanding of ICT project benefits
  - If the political challenges are beyond the scope of the project, determine steps to mitigate the effect on the project
- *C8. Significant participation of community target groups in the project*
  - Encourage community participation in determining the goals and benefits of the project
  - Select target groups that represent the social groups (women, youth, local leaders) in the community to participate in the planning, analysis, implementation and evaluation of the project
  - Discuss the limitations and risks of the project, especially with regard to the impact it has on the social, and cultural norms of the community
  - Encourage participation to empower the community to express their local needs and requirements with regard to ICT use as an enabler of development

  - Select target groups in the community to participate, who are specifically involved in rural development activities

- *C9. Focusing on local/demand driven needs*
  - Aim to understand the rural market that is being targeted. For instance, in terms of diverse local conditions, different populations, economic bases, cultures, social organisation, and levels of need.
  - Incorporate initial ICT literacy training, education and awareness to stimulate demand for ICT use in rural development activities
  - Select an appropriate methodology to elicit local requirements and needs for the ICT project. Conduct a needs assessment to elicit local requirements and needs among target groups that participate
  - In the initial assessment of local needs, leave room for further assessment to respond to demand as usage patterns emerge and active needs can be identified. Continuously monitor demand through active participation and feedback from stakeholders
- *C10. Building on local information and knowledge systems*
  - Research the rural environment to understand how traditional information is gathered, stored, shared, and evaluated
- *C11. Appropriate training and capacity building*
  - Conduct a skills audit regularly to identify existing skills and aptitudes in the community, and subsequently determine capacity gaps
  - Identify social and cultural barriers to training (for example, illiteracy and language barriers) and develop a training structure that mitigates the influence of these barriers
  - Design an appropriate training structure for effective and widespread training in the rural community
- *C13. Existing motivation and incentive for ICT job placement in the community*
  - Plan to create job placements as rural community members acquire ICT skills
- *C14. Focus on economic self-sustainability – business development and entrepreneurship*
  - Plan for a sound business model to promote a self-sustainable economic base for a telecentre or ICT service provided. From the outset, develop a solid business model that includes mechanisms for growth and replication in the community

- *C15. Encouraged local ownership*
  - Define the type of ownership assumed by local stakeholders at different stages of the project
- *C16. Building local partnerships*
  - Limit the scope of the project by incorporating partners in particular project areas
  - Research and identify appropriate partners locally and nationally to review their capacities and competencies for potential partnership
  - Select partners who share the same objectives and complement the project, and encourage them to participate in the project. This pools expertise and knowledge, and concentrates resources
  - Develop and communicate a Memorandum of Understanding for project partners
    - Define the scope and guiding principles of the partnership
    - Communicate the goals of the project
    - Define the roles and responsibilities of partners
    - Define resources needed to support the project
    - Define activities and expected deliverables
    - Define expected outcomes and timeframe
- *C17. Choosing the appropriate or right technology*
  - Choose technology that is sensitive to illiteracy, language, and educational constraints identified and experienced in rural communities.
  - Employ flexible and innovative ICTs that are sensitive to rural requirements, needs and the existing rural ICT infrastructure. Plan to deploy simple technology for basic information requirements where necessary
- *C19. On-going monitoring and evaluation of the project*
  - Develop a plan for monitoring and evaluation throughout the project
  - Select and train staff to monitor and evaluate the project, and hence understand the importance of doing so

4.4.1.3 Implementation

All the tasks and activities identified in the development phase are implemented at this stage. The application and implementation of a rural ICT project is particularly susceptible to the rural requirements and project constraints identified in the development phase. The project team

continuously builds on factors that equip the community to promote the impact and sustainability of the project in rural development activities. The project is also continually monitored and controlled to keep the project and its impact on track. The CSF practices that should be incorporated into this phase include:

- *C3. Using ICT to enhance existing rural development activities*
  - Collaborate with development organisations and existing projects in the community in the rural ICT project process
- *C4. Cultivating an enthusiastic influential project champion*
  - Do not rely on only one project champion, but devise mechanisms to train and build the capacity of certain individuals to drive and lead the project
- *C5. Incorporating socially excluded groups*
  - Be aware of the negative factors that cause certain social groups to self-exclude themselves, so as to alleviate the influence of the factors on the project
  - Include women and youth from the community in project implementation to effectively determine barriers and encourage involvement.
  - Promote the participation of women or youth as ICT users, managers, vendors, and entrepreneurs through for instance, considering gender relations, roles, and patterns to resource access
  - Consider rural activities in which certain social groups are involved, so as to encourage participation
- *C6. Incorporating/Awareness of specific ICT policy influencing the project*
  - In the long-term, appoint and equip local project stakeholders to represent the rural community in helping to frame appropriate ICT policies that can be effectively implemented in rural areas
  - The local stakeholder should network, lobby, monitor, document, evaluate and disseminate ICT policy discussions and developments
- *C7. A good understanding of the local political context*
  - Ensure a constant flow of communication among political gatekeepers and the project team about political changes, hence allowing the project to be less vulnerable to any significant political shifts

- *C8. Significant participation of community target groups in the project*
  - Provide continuous feedback and communication to inform the community of any changes and enhancements to the ICT project
- *C10. Building on local information and knowledge systems*
  - Build ICTs based on existing community knowledge systems
  - Identify and meet with local information intermediaries to discuss existing knowledge systems
- *C11. Appropriate training and capacity building*
  - Train the rural community to use ICTs so as to create an initial awareness of the potential of the technology in supporting rural development activities. For instance, introductory computer literacy training
  - Initially provide training free of charge to encourage the community to get involved and become aware of the potential of ICT
  - Select key gatekeepers in the community (e.g. local knowledge workers, intermediaries, youth, and motivated entrepreneurs) to be trained, such that they can train other people in the community (and eventually adapt a training structure appropriate to the community and more integrated in community activities)
  - Encourage a mentorship programme among trained community members to disseminate skills in the rural community
  - Train local people to produce ICT content that is relevant and applicable to their rural environment
  - Equip local people with technical skills to set up and maintain ICT equipment (especially refurbished computers)
  - Develop the capacities of local people to design, decide upon and execute ICT enabled activities in the community – business and development activity support
  - Provide refresher training courses regularly to keep the community informed
- *C12. Facilitating local content development*
  - Involve the targeted rural population in identifying the content needs of the community
  - Train and instruct target groups on how to collect information and reorganise it in a comprehensive meaningful manner that is locally understandable

  - Apply and consider language compatibility, communication habits, cultural norms, literacy, use of appropriate taxonomies, and intellectual property (creative commons) rights, in content development

- *C13. Existing motivation and incentive for ICT job placement in the community*
  - Practice ICT project training that responds to the job market need, assists trainees with job placements, and equips them with proactive skills for finding jobs
  - In the case of managing telecentres, aim to train people who originate from the rural community, who understand the rural environment
  - Plan to provide incentives and motivate local staff to continue working in the telecentre – retain human resources, in-house skills, and intangibly support project participants
- *C14. Focus on economic self-sustainability – business development and entrepreneurship*
  - Foster entrepreneurship and creativity in the rural community that is directly or indirectly supported by the ICT services
  - Allow a steady flow of external income to grow and replenish ICT services – helps in developmental interventions that change the existing information communications systems in the rural area
- *C15. Encouraged local ownership*
  - Empower local stakeholders through processes of transformation (education, awareness raising and local engagement) and capacity building (soft skills in finance, business management and communication)
  - Limit direct project roles and responsibilities of external actors (donors) in the design and formulation of projects, to encourage local stakeholders to take the lead and participate more in the project
  - Incorporate meetings where owners can gather, engage in dialogue, become decision makers, review roles and responsibilities to adapt to evolving situations in a dynamic project
  - Practice transparency and appropriate representation in community ownership to mitigate the influence of local politics
- *C16. Building local partnerships*
  - Monitor the expectations of partners, such that they are aligned, to avoid discouragement and frustration with the project

- *C17. Choosing the appropriate or right technology*
  - Adapt technology based on open standards, applying a technology neutral approach – open source application. However, practice careful decision making when implementing such technology which has its limitations
  - Consider deploying refurbished computers in rural areas to reduce purchasing costs. Keep newer and faster computers for Internet access and downloading, while using refurbished computers for basic ICT services (typing documents)
  - For more affordable and accessible ICT, consider complementing traditional and modern ICTs
- *C18. Building on existing public facilities*
  - Encourage the community to provide a space or building that is rent and maintenance free – physical commons
  - Select a building that at least has electricity, security, and a telephone connection (if no wireless technology)
  - Implement the telecentre in an appropriate location, that is visible and accessible
  - If it is not possible to implement the telecentre in a visible place, develop a marketing strategy that focuses on creating awareness of the project
- *C19. On-going monitoring and evaluation of the project*
  - Monitor and evaluate the rural ICT project throughout the life of the project
  - Use results of monitoring to enable a project to adapt and tailor ICT services to any changes in demand and circumstance
  - Consider best practice characteristics as the project status is monitored, so as to apply it to the existing project continuously, or influence future projects positively
  - Compile regular reports to show project progress – develop a template for a project status report
  - Incorporate regular meetings and discussions based on project monitoring reports among project stakeholders (including donors and community) regarding the project's progress, impact, and required adaptations

4.4.1.4 Close-out

Project work is completed at this stage, and if successful the community accepts and integrates the project at a certain level in rural development activities. The project team hands the project over to

the community to fully manage, and establishes to what extent they will be involved in the maintenance and assistance of ICT services provided in the community. The CSF practices that should be incorporated into this phase include (Note: some practices are associated with more than one CSF):

- *C8. Significant participation of community target groups in the project process*
  - Meet with significant stakeholders in the community to discuss the impact of the project and the way forward for the on-going operation of ICT services
- *C9. Focusing on local/demand driven needs*

  C8. Significant participation of community target groups in the project process
  - Verify and establish the requirements of the rural ICT project are met, and to what extent.
- *C15. Encouraged local ownership*

  C16. Building local partnerships
  - Confirm continuing ownership and partnerships involved in the project to keep it sustainable
- *C19. On-going monitoring and evaluation of the project*
  - Determine the extent and duration of funding by the sponsor to continue to develop the ICT services in the community. In addition, the extent to which non-local project team members will assist with maintenance after the project has been handed over to the community must be determined.

4.4.1.5 Post Implementation Review

Once sufficient time (9-15 months) has passed after project close-out, the rural ICT project should be assessed to determine if sustainable benefits were delivered and what impact the ICT project has had on the rural community. The CSF practices that should be incorporated into this phase include:

- *C19. On-going monitoring and evaluation of the project*
  - Continually visit the rural community to assess the sustainability and impact of the rural ICT project
  - Document and publish evaluation results and lessons learned such that projects with similar initiatives can promote the effectiveness and sustainability of rural ICT projects

4.4.2 A Reflection on the Rural ICT Project Life Cycle

The RICT-PLC is a proposed guideline to implementing rural ICT projects based on literature, lessons learned and good practice in case studies of rural ICT projects. As was stated in Chapter 3, the importance of some CSFs and their associated practices depend on the objectives of the particular rural ICT project. In some cases, the application of these CSF practices under each phase may vary among projects, considering the particular influence of the factor on the project. Nevertheless, most of these factors, to an extent, play a significant role in promoting sustainability across a variety of projects.

The practices under each phase illustrate that sub-projects can exist within the rural ICT project life cycle, which may also have project lifecycles of their own (Kerzner, 2003: 72; Maylor, 2003: 28; PMI, 2000: 13). For example, the inclusion of business skills development may involve a sub-project alone that promotes entrepreneurial skill in the community, with the support of ICT. The RICT-PLC does acknowledge the existence of ancillary projects (business skills development) to promote the sustainability and relevance of the main project in the community. According to Kerzner (2003: 72), in order to resolve conflict and establish priorities, multi-project management in the project life cycle should consider the following questions:

- Are the project objectives the same?
    - For the good of the project?
    - For the good of the community?
- Is there a distinction between large and small projects?
- How do we handle conflicting priorities?
    - Critical versus critical projects
    - Critical versus non-critical projects
    - Non-critical versus non-critical projects

It is good practice to view the larger rural ICT project as a series of smaller, manageable projects, particularly since the complexity of the environment can result in a high degree of uncertainty (Schwalbe, 2006: 59). Completing one project at a time successfully can eventually lead to the success of the larger project.

The aim of this research study is to develop a guideline for ICT project management in rural areas that identifies the people, environments, technologies, systems and requirements for ICTs to support

rural development activities. An investigation of existing rural ICT projects using the case study approach can reveal the approach adopted for implementing and managing projects with a view to promoting sustainability. This reveals *how* the life cycle of each case study project progresses, and *why* particular case studies consider certain practices within the phases of their project life cycles. Some projects may exercise some of the CSF practices of rural ICT project sustainability, and may also exercise other factors, possibly depending on the unique project objectives and context. Furthermore, the CSF practices that fall under each phase of the RICT-PLC (concept, development, implementation, close-out, and post implementation review) could possibly be divided into logical groups that define sub-phases of the project life cycle, judging from the number of practices that fall under some phases. An investigation and comparison of existing ICT projects could reveal some sub-phases that possibly make up the life cycle of a rural ICT project.

4.5 Conclusion

The development community has responded to the use of ICT as an enabler of rural development in the growing information society by implementing various ICT projects in rural communities. The concept of project management therefore needs to be understood in its application to rural ICT projects. The two main approaches to project management that most industries use include the Project Management Framework and PRINCE2 developed by the Project Management Institute (PMI) and the Central Computer and Telecommunications Agency (CCTA) (adapted by the APM group) respectively. A rural ICT project could possibly use either one of these approaches. However, it is important that the approach is sensitive to the project environment in which it is applied, so as to view the project holistically. The rural environment deals particularly with rural society, economic, and technological issues that can affect the sustainability of the rural ICT project. All these issues relate to the project life cycle that consists of phases through which the project progresses. Rural ICT projects can therefore be viewed as a series of inter-related phases that promote project sustainability in a complex rural environment, prompting the development of the Rural ICT Project Life Cycle (RICT-PLC).

The RICT-PLC proposes the phases through which a rural ICT project should progress, particularly in relation to the critical success factors of project sustainability that should be practiced. The practices associated with the CSFs of sustainability should therefore be used together with the theoretical project management techniques generally used in projects. In order to have a better understanding and application of the life cycle through which rural ICT projects progress, a real-life

interpretative case study investigation needs to take place to reveal the approach adopted for implementing and managing existing rural ICT projects toward promoting sustainability.

Chapter 5

Case Study Research Methodology

Chapter Four explored the project management practice and proposed a model for rural ICT projects. This chapter describes the research methodology adopted to investigate existing rural ICT projects. The qualitative research methodology and case study design for the case study investigations are described.

5.1 Introduction

A real-life investigation of existing rural ICT projects reveals the approach adopted for implementing and managing rural ICT projects toward promoting sustainability. A case study investigation provides the data and environment for this kind of interpretation. This chapter describes the research methodology for investigating existing rural ICT projects.

The qualitative research methodology is adopted and described as the most appropriate approach to analysing real-life rural ICT project environments. The chapter then describes the case study design applied to the investigation of the two rural ICT projects, Dwesa and RUMEP (MathsNet). The case study design aspects include the research questions, the unit of analysis, the research instruments to be used, and the approach to analysing the data for each case study.

5.2 Qualitative Research Methodology

A qualitative research methodology has been adopted to assess the rural ICT project life cycles in real-life rural ICT project environments. Qualitative research uses qualifying words and descriptions to record aspects about the world through qualitative data, such as interviews, documents, and participant observation, to understand and explain social phenomena (Myers, 1997: 241). The methodology is sensitive to understanding and analysing the perspectives of human experience through a process of description that is expressive and persuasive in language (Bless and Higson-Smith, 2000: 38; Creswell, 1998: 14; Gillham, 2000: 11). This research study adopts the following definition of qualitative research (Creswell, 1998: 15):

> *"Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyses words, reports detailed views of informants, and conducts the study in a natural setting."*

As the research study investigates *how* particular ICT projects implement and manage projects in rural areas with the aim of promoting the sustainability of the project and *why* they use a specific approach, a strong rationale exists to use the qualitative methodology (Creswell, 1998: 17). A qualitative approach explores and provides a detailed view of a particular case, as variables associated with the rural ICT project may not be obvious or easily identifiable. A rural ICT project can also be studied in its natural setting using the qualitative approach, where a project can be investigated in its particular context by going out to the field of study.

There are different qualitative approaches of inquiry such as a biography, ethnography, phenomenological study, a grounded theory study, and a case study. The investigation of rural ICT projects will, however, adopt the case study research approach as it aims to explore and describe how existing rural project cases are implemented and managed. According to Yin (2003: 13):

> *"A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"*

Consequently, the ICT project life cycle in a real-life rural ICT project case and the existing implementation of project management techniques receptive to the CSFs of sustainability can be assessed. The case study approach is a powerful method of research that can provide real-life information and evidence (Yin, 1993 in Niazi, Wilson, and Zowghi, 2005: 216). This real-life evidence can contribute to the development of an enhanced RICT-PLC model applicable to the rural ICT environment.

5.3 The Case Study Investigation Design

The research design provides a logic which links the data to be collected and conclusions that are to be drawn, to the initial research questions of the study (Yin, 2003: 19). A multiple case study design is to be used, which entails an investigation of more than one case of a rural ICT project with the purpose of conducting a comparative study (Yin, 2003: 46). A comparative study can demonstrate the possible application of the model in different rural ICT project situations, especially in accordance with the CSFs applied in the different projects. Two case studies have been chosen for a comparative analysis of the project life cycle applied to a specific rural ICT project. Each of these case studies is unique in their project objectives; however, it remains interesting to interpret their approaches to implementing and managing their projects in rural environments. The Dwesa ICT project provides a typical example of a fairly new project (no previous experience in implementing rural ICT projects), whereas RUMEP (MathsNet) provides an example of a more established mature project with a history that has developed best practice then applied in its MathsNet project over the past few years. Multiple case studies can strengthen the investigation by replicating the pattern-matching of cases and hence increasing robustness in the theory (Tellis, 1997: 4). The important research design components that guide the case study research investigation are described as follows:

5.3.1 The Case Study Research Questions

Two research questions have been chosen to guide the case study investigation, exploring 'how' and 'why' the life of the project is approached in a particular way. The two research questions are:

a) How is the rural ICT project implemented and managed throughout its life cycle to promote project sustainability?
b) How do the phases and practices relate to the proposed RICT-PLC model?

5.3.2 The Unit of Analysis

The research study aims to apply a traditional project life cycle to a rural ICT project that is adaptive to the complex rural environment. The investigation analyses the phases and practices of the project life cycle for each case study, considering the specific uses and challenges faced in the project. The units of analysis are the *Phases and Practices of the Project Life Cycle.*

5.3.3 The Research Instruments

The main instruments used as sources of evidence in both case study investigations include interviews, documentation, and participant-observation.

5.3.3.1 Interview

The interview to be used in both case studies was designed as follows (adapted from Creswell, 1998: 123):

a) *The type of Interview:* A *semi-structured* approach is adopted for the interview process. The questions in the interview are structured; however, the interviewer is not necessarily restricted to the set questions. Instead, the questions available constitute an interview guide/schedule, with prompts in some topics to explore/probe for other information. Even though respondents are asked the same questions, the interviewer may adapt the interview formulation and terminology to fit the background and knowledge of the respondent (Welman and Kruger, 2002: 161).
b) *The people to be interviewed:* Members of the project team in both case studies are interviewed. These particular people are familiar with the progressive life of the ICT project, in relation to the phases and practices applied. The project team may include, for example, the project leaders, project managers, trainers, and those involved in implementing the technology. The community in the Dwesa case study are also interviewed to explore their different perspectives on the uses and challenges of ICT, especially at an early

emergent stage of the Dwesa project. The community to be interviewed includes the two project champions, the School Headmaster, and two community members involved in the project. The RUMEP Director and MathsNet Facilitator are interviewed for the RUMEP case study. There are many rural community members existing at 15 RUMEP clusters, therefore, their views on the uses and challenges of ICT are limited to the *documented* project reports that generalise the views of all community clusters. Interviews are not conducted with the RUMEP community teachers who are spread throughout the Eastern Cape.

c) *How the interview is conducted:* The interview is conducted using both a one-to-one, and focus group approach. The application of both approaches is used in the Dwesa case study. There are conflicting views of the project, which can make the interview process difficult due to differing points of view that exist among the respondents. It was the request of one of the project team members to conduct an individual interview because of the concern of not being able to fully express their views in a group interview. On the other hand, a group interview is maintained for some project team members, particularly the Fort Hare research team. A video conference group interview is conducted with the Fort Hare team, as they do not reside at Rhodes University. The RUMEP interview adopts the focus group approach, where only the RUMEP Director and MathsNet Facilitator are interviewed, as their significant involvement in a more established ICT project provided sufficient information. The approximate length of the interview is 1 hour to 1 hour 30 minutes, depending on whether it is a one-to-one or group interview.

d) *The interview equipment:* The interview equipment to be used includes:

- *Recorders:* Two recorders are used to record the interview, namely, a tape recorder and a digital recorder for backup.
- *Writing pad, pens, pencils, and highlighters:* For taking notes during the interview. The notes taken are based on each interview question. The notes may be incomplete and partial because of the difficulty of asking questions and writing answers. Nevertheless, they still provide a backup for any lost recorded data.
- *Sweets and 'thank-you' notes* for an appreciation of the respondent's participation in the interview
- *Video conferencing facility* to conduct an interview with the Fort Hare research team.

e) *Consent from the interviewees to conduct an interview:* An email is sent to people chosen to be interviewed in each case study. This letter explains the aim of the research, and the relevance of the interviewee's project as a case study in the research. It also explains the interview process in terms of the type of questions to be asked, whether it is a one-to-one interview, the approximate length of the interview *etc*. A set of dates for the interview is proposed, but the interviewee is not necessarily restricted to those dates.

f) *The Interview Schedule:* This guides the interview for each case study. A copy of the interview schedule is provided in Appendix D. The schedule developed considers the following factors (Welman and Kruger, 2002: 165):

- There are a set of questions specific to the project team, and a set of questions specific to the community.
- The questions are open-ended, whereby respondents formulate their own responses.
- The level of knowledge of the respondents is also taken into consideration, by formulating questions using words with which the respondent is familiar.
- The interview questions aim to maintain neutrality in data collection, in that they do not suggest a particular response or intimidate a respondent into giving a specific answer (for example, "Do you agree that…").
- The sequence of the questions is set appropriately. Earlier questions are on simple aspects of the project to make the respondent feel at ease. Later on, more in depth questions are asked. Questions that are related to the same aspect are grouped together so that respondents do not repeatedly have to switch their focus. Transition from one topic to the next is clearly identified and connected to the stated aim of the project.

5.3.3.2 Participant Observation

Participant observation allows the observer to investigate aspects of the project directly, through their involvement in project operations. This instrument is used in the Dwesa case study to observe the life of the project at a different angle, from its early stages of development to its intermediate operation. The following factors were considered in the approach to participatory observation (adapted from Creswell, 1998: 125):

a) *Identification of who or what, to observe, when and for how long:* the project team's activities would be observed, together with the response of the community to the

implementation and management of the project. An observation of the project would take place from November 2005 to September 2006 on various research project field trips.

b) *Role as Observer:* The role of observer is ultimately participant, although the participation is limited to assisting in delegated project tasks. Participant observation would not necessarily interfere with the general operation of the project. Nevertheless advice would be shared and given where necessary.

c) *Observation Equipment:* The following equipment is used in each field trip observation:
   - *Writing pad, pens, pencils, and highlighters* for taking observation notes
   - *A digital camera* to photograph project activities

d) *Observation Protocol for recording notes:* Notes are taken on each field trip observation. The aim of each field trip, and the stakeholders involved is recorded for each project report. This is followed by observation notes for each day of the field trip (often lasts for five days). The informal notes are organised and compiled as a project progress report. Observation of the project team occurs at various project meetings held by the team.

Participant observation is also used in the RUMEP MathsNet Project, but to a limited extent. The researcher only assisted with training some teachers from a few clusters in basic computer literacy, when they attended computer training, at Rhodes University in July 2006, for their Advanced Certificate in Education (ACE). Training observations are made, and the teachers are informally interviewed on their response to the technology, and the challenges they face.

A brief description of how each instrument was used for each case study follows:

i. ***The Dwesa ICT Project:*** The research instruments include participatory observation, documentation and interviews. The Dwesa project became a main focus for data collection especially considering the early stages of project development and involvement from the start of the project. The research investigation on this case study was significantly more intensive and direct than the other case study, as this project was observed from when it started in November 2005 to September 2006.

   Participant-observation: The researcher was exposed directly to the operations, practices, and challenges associated with the project through participatory-observation from early development to intermediate operation. This included an observation of the project from November 2005 to September 2006.

   Interview: The interviews were conducted in September 2006, the last month of data collection. The project team was interviewed separately from the community to explore

their differing views in relation to the project's operation and approach to promoting sustainability. Altogether, the project team, the project champions, and community members were interviewed in their three respective groups.

Documentation: This consisted of project funding proposals, project progress reports, the community training register, and published background research of the Dwesa area by Palmer, Timmermans, and Fay (2002).

ii. ***Rhodes University Mathematics Education Project (RUMEP) – MathsNet:*** The research instruments include an interview and documentation

Interview: The RUMEP Director (Rose Spanneberg) and MathsNet Facilitator (Mark Sainsbury) were interviewed together as part of the project team.

Participant-observation: The researcher assisted in computer literacy training of teachers, and informally interviewed them on their response to the technology and challenges they face. The training approach and structure of MathsNet is also observed.

Documentation: This consisted of the RUMEP 2005 Annual report, the Eastern Cape Department of Education report, two publications/reports from Mark Sainsbury and Bruce Brown, the Electronic Equipment Agreement for each cluster, and the Cluster Hardware Preparedness Rating Checklist for assessment.

5.3.4 Approach to Analysing the Data for Individual Case Studies

The data collected from each case study is analysed to extract relevant themes and their incidence or frequencies. The approach that is adopted is content analysis which uses a special application of systematic observation to examine the data collected for key themes (Welman and Kruger, 2002: 195). The procedure is as follows:

a) Firstly, once the data is collected, a list of information that is required from the data is defined and outlined. For example, the contents required for the case study investigation included the rural context, project objectives and goals, the uses of ICT, the challenges to ICT use, phases of the project life cycle, areas for improvement, *etc.*

b) Secondly, the documentation and reports are reviewed, and the interview recordings are studied to extract key themes of the ICT project. These key themes are noted and recorded under each content heading defined in the first step. Aspects (or themes) associated with the phases of the project and its context are then drawn from the data collected under each content heading. A review of the content provides the basis for the description and analysis of the case study.

5.4 Conclusion

The qualitative research methodology is suitable for an investigation of current rural ICT projects. A qualitative approach of inquiry appropriate for this investigation is a case study. The case design provides a guideline to effectively collect data, and identifies an approach to analysing it. The case study research methodology used provides a real-life interpretation of the approach to implementing and managing ICT project in rural areas.

Chapter 6

Case Study Exploration of Current Rural ICT Projects

Chapter Five presented the case study research methodology adopted. This chapter provides an interpretive case study of two rural ICT projects in terms of their project life cycle and practices adopted in implementation and management to promote rural ICT project sustainability. The two case studies are the Dwesa ICT Project, and Rhodes University Mathematics (RUMEP) ICT Project (MathsNet).

6.1 Introduction

Rural ICT projects progress through a life cycle which applies certain practices to promote the success and sustainability of the project in a complex rural environment. An examination of existing rural ICT projects provides a real-life interpretation of the approach to implementing and managing ICT project in rural areas. The aim of this chapter is to provide an interpretive case study of two rural ICT projects in terms of their project life cycle and practices adopted in implementation and management to promote rural ICT project sustainability. The two case studies are the Dwesa ICT Project, and the Rhodes University Mathematics (RUMEP) ICT Project (MathsNet). A multiple case study presents a comparison of different ICT project approaches, and reveals common and distinct practices that could be adopted throughout a rural ICT project life cycle.

For each case study, a brief description is presented to put the project into perspective. The phases of each rural ICT project life cycle are then explored to identify their practices and approach adopted as the project progresses. Subsequently, the uses of ICT and the challenges faced by the community and project team (associated with the uses, and project implementation and management) are considered and examined. The final description of the case study provides an analysis of the phases of the case study project life cycle, in relation to the RICT-PLC model.

Finally, the conclusion summarises the findings and identifies any additional characteristics and practices applicable to a realistic rural ICT project environment which can contribute to an enhanced model of the RICT-PLC.

6.2 The Dwesa ICT Project

The Dwesa ICT project consists of a collaboration of research projects between the Telkom Centres of Excellance (COE) at Rhodes University and the University of Fort Hare. The aim of the Dwesa ICT project is to develop an open source/standard e-commerce/telecommunications platform to deploy within rural and semi-rural areas in South Africa. The ICT project therefore endeavours to promote e-commerce in tourism (through the nature reserve which is a chief community asset) and other rural development activities. A detailed description of the Dwesa case study can be found in Appendix E.

The Dwesa ICT project that commenced in November 2005, is in its early stages of development, and provides an opportunity to observe the project management techniques applied to promote sustainability. The researchers in the project consist of postgraduate students experiencing an ICT project in context for the first time.

The rural communities that exist in Dwesa include Mpume, Ntubeni, Ntlangano, Ngoma, and Mendwane. The Dwesa ICT project team chose to implement the project within the Mpume community, at Mpume Primary-Junior Secondary School. The school Headmaster and teachers are very supportive of the project, the school holds a good standing in the community, and conveniently acts as a point of access for community meetings and activities.

6.2.1 The Project Context

Dwesa is a rural area situated within the former Transkei region, along the wild coast of the Eastern Cape Province of South Africa. It forms part of the Dwesa-Cwebe area which comprises the protected area (nature reserve) and frontline communities extended over a land area of approximately 15 254 hectares (Palmer, Timmermans and Fay, 2002: 2). The Dwesa-Cwebe area is divided into two administrative areas, which encompass the northern side of the Mbashe River – Hobeni and Cwebe that together form Cwebe, and the larger of the two areas to the south of the river – Mendu and Msendu which together form Dwesa. These two areas administered jointly form the Dwesa and Cwebe nature reserve. The location of Dwesa-Cwebe is shown in the map in Figure 12.

The Dwesa-Cwebe areas have both become involved in a development initiative as the natural environment consisting of the nature reserve and wild coast that they share are a chief asset for the communities (Palmer *et al.*, 2002: 279). This chief asset (unspoiled natural scenic beauty and wild beaches) serves to provide income generating activities to support rural development in the area. Furthermore, the high levels of rainfall and rich soil contribute to great potential in controlled agriculture intensification and commercial forestry. Nevertheless, the vision for development for Dwesa-Cwebe has been to take advantage of their rich natural asset. The ownership of the land has recently been restored to the community. As a result, the community has pooled grants they have received from their restoration package, and invested in the development of local tourism infrastructure.

Figure 12: Location of Dwesa-Cwebe on the Eastern Cape Wild Coast (Palmer, Timmermans and Fay, 2002: 3)

Currently, tourism development in Dwesa is hampered by a scarcity of knowledge and experience of tourism in the community, and hence there is limited community involvement. Development focuses and relies on natural capital: the nature reserve. However, potential exists in authentic cultural and heritage tourism, associated with Dwesa-Cwebe's rich Xhosa tradition and recent historical background as a former designated homeland (Palmer *et al.*, 2002: 273).

Dwesa-Cwebe is faced with socio-economic challenges associated with poverty and poor development. Therefore, this area has recently been a target for development projects. Building communication and rural development can subsequently be supported by ICTs, which can enable the effective operation of existing development activities.

6.2.2 The Project Stakeholders

The stakeholders of the Dwesa ICT project are:

Rhodes University Researchers

- Prof Alfredo Terzoli *(Project Leader and Academic Supervisor)*
- Bradley Whittington
- Hannah Slay *(Post Doctorate assistant of the COE)*
- Lorenzo Dalvit
- Mamello Thinyane
- Robert Alfonsi

The University of Fort Hare Researchers

- Prof Hyppolite Muyingi *(Project Leader and Academic Supervisor)*
- Gary Ndlovu
- Martin Mandioma
- Naomi Isabirye
- Paul Tarwireyi
- Sicelo Njenje
- Thandeka Mapi

The Teachers at Mpume School in Dwesa

- Mr Pakati *(Headmaster)*
- Mr Jabe *(Deputy Headmaster and Project Champion)*
- Mrs Gxarisa *(Project Champion)*
- Mr Xatasi
- Ms Mangwane
- Ms Mpahlwa
- Mrs Sotyhatya
- Mrs Mgoqi
- Mr Yose
- Mrs Ndomfanya

Community Members (Assist in Training)

- Neziswa Mcingi *(Pinki)(Youth Project Champion)*
- Andisiwe Mcinga
- Noluvo Mgedezi

6.2.3 Project Objectives

The main objective of the Dwesa rural ICT project centres on the development of an e-commerce platform. The objectives of the project are as follows:

a) The primary objective of this project is to develop and field-test the prototype of a simple, cost-effective and robust, integrated e-commerce/telecommunications platform, to deploy in marginalized and semi-marginalized communities in South Africa, where the majority of the South African population live.

b) The second objective of this project is to build technically skilled human resources in the field of e-commerce, particularly, but by no means only, in the context of supporting e-commerce activities in marginalized and semi-marginalized communities.

In order for the above objectives to be achieved, sub-projects exist to support the main project objectives. The title of research sub-projects by each student is as follows (detailed descriptions can be found in Appendix E):

A) *Eliciting user requirements for an e-commerce platform for entrepreneurs operating in Dwesa*

B) *The adoption of ICTs in rural areas (a study of Dwesa community in Transkei)*

C) *Backhaul connectivity options for Dwesa*

D) *Low cost, IP-based access loop for consumer telephony in rural communities*

E) *Software Engineering of a robust, cost-effective e-Commerce Platform for Disadvantaged Communities*

F) *Developing an Internet Cost Management System for marginalized communities*

G) *Development of a music component for e-commerce using indigenous knowledge system*

H) *Implementation of Knowledge (Learning) Networks through ICTs in Marginalised Communities*

I) *Language problems in ICT Education*

J) *E-literacy course for teachers using free open source and b-learning*

6.2.4 The Sustainability of the ICT Project

The sustainability of the Dwesa project is crucial for it to have a positive impact on the community at large. However, the aim of promoting the sustainability of the Dwesa rural ICT project does not appear be prominent in this particular case study. Nevertheless, some of the sub-projects that support the e-commerce platform essentially have a sustainability agenda in relation to their individual research objectives. For example, Project A aims to elicit the local requirements and needs so that the ICT project that is implemented becomes relevant and applicable to supporting the rural development needs in the community. This supports the social and cultural, and institutional categories of sustainability.

Although some of the sub-projects promote different categories of sustainability, it is still not clear how these projects will be integrated to achieve the overall sustainability of the project. An interview with the project team and a review of documentation disclosed that the overall project focuses on promoting the *commercial sustainability* of the project, such that industry sponsors may exploit the particular project. However, this only addresses one category of sustainability. It needs to become clear to the whole project team, how to target the overall sustainability of the project, especially through the collaboration of sub-projects.

The understanding of the meaning of sustainability of the project varies. According to a project team member, the key question to ask is whether the sustainability of the project focuses on the sustainability of ongoing tertiary research at Dwesa, or the sustainability of the ICT project in the community itself. The former currently shows potential in terms of future research projects arising. However, the long-term sustainability of the project in the community may be a challenge. The project team needs to clearly define their approach to promoting the sustainability of the project in Dwesa.

6.2.5 Project Management and Life Cycle Characteristics of the Project

The Dwesa ICT project is significantly a *reactive* driven project. No formal project management approach has been adopted, and decisions are made in an *ad hoc* manner. The project team aims to implement a project that is adaptable to any changes in the environment that influence the project's progress. Planning in the project is limited, as it is assumed that a formally planned project would limit the flexibility of the project. This obviously has had negative repercussions on the implementation and management of the project. Nevertheless, the project has managed to be operative continuously from November 2005, and continues to be supported by the community. It therefore becomes interesting to examine aspects of the project's current and planned implementation and management practices throughout its project life.

The project team occasionally met to discuss plans for field visits and the progress of the ICT project. The communication tool for group meetings between Rhodes University and the University of Fort Hare was a video conferencing system. However, most informal planning was done via emailing on the Dwesa mailing list. Even though the team had decided not to have an overall project manager, and instead decided together on the plans for the trip, the planning tended to be done by certain individuals in the group. Some researchers preferred to focus on their own research, and therefore did not contribute much to the planning of the overall project.

The Dwesa ICT project is *iterative* in nature, especially given the fact that it deals with a number of sub-projects. Each of these sub-projects has a life cycle of its own that is applied differently in each phase of the overall project. Iterative and incremental development is practiced whereby the project team does not follow a rigid waterfall approach, but instead implements segments of each sub-project at each phase of the overall project. This enables the project to adapt to any changes associated with the dynamic rural environment that are experienced throughout the project's life cycle. Since most of the research sub-projects last for two years (duration of a masters degree), the project leaders intend to extend (incremental) existing projects for future research with future postgraduate students, in order to build and test the final e-commerce platform.

6.2.6 ICT Applications Used

The ICT applications mentioned below are the technologies that have been implemented. Whilst other technologies will be adopted in the future development of the platform, currently the technology implemented includes:

6.2.6.1 Hardware

- **A VSAT** (Very Small Aperture Terminal) which is an earthbound station used in satellite communications of data, voice and video signals, excluding broadcast television (Pagarkar, 2004: 1).
- **A WiMAX (Worldwide Interoperability for Microwave Access) Terminal**. This forms part of Projects C and D, on appropriate communication technologies for rural areas as it will eventually host a potential fixed telephony service among different communities in Dwesa.
- **10 Personal Computers:** Nine computers are setup as a thin client running off one server (where the necessary resources needed by each individual PC are hosted)
- **Storage devices - Flash Disks:** These were distributed to teachers and community trainers

6.2.6.2 Software

- **The Edubuntu Operating System:** An open source Linux-based operating system designed for school environments
- **The Gutenberg Project:** A collection of free online books.
- **Wikipedia:** A free content encyclopaedia of information on many different subject areas collaboratively written by people around the world

6.2.7 Phases of the Dwesa ICT Project

The progressive life of the Dwesa ICT project was undertaken through repeated field trips to the community. The phases of the Dwesa ICT project are not clearly defined, and therefore it was a challenge to determine phases associated with the project's life cycle. A review of field observation reports reveals a focus and commonality among the trips taken at different periods of the year, from November 2005 to August 2006. Each field trip tended to focus on specific aspects of achieving the objective of the project, but were not limited to an individual activity that needed to be implemented. Different field trips therefore portray the life of the project, and present the approach used for implementing and managing the project. However, it is important to note that each field trip was incremental and iterative, in that some activities would be repeated and built on from previous phases. Nevertheless, these previous phase activities would not be the main focus of activities which determine the name and characteristic of the current phase.

According to the project team, the Dwesa project is currently in its first stage, where the focus has been on achieving community buy-in and involvement, and training the community to be competent

and confident in their use of ICTs. The technical side of the project has centred on achieving an Internet connection and developing a pilot WiMAX link between Mpume School and Ngwane. A brief description of the phases of the Dwesa project is as follows (a detailed description of the phases of the project can be found in Appendix E):

1. **Project Idea Generation and Concept (January – October 2005)**

   This phase of the project is associated with generating a proposal for the project, which defines the needs and concepts that underlie the project. The idea of the research project emanated from collaboration with the Telkom COEs at the University of Fort Hare and Rhodes University to promote research in e-commerce for marginalised communities in South Africa. As a result, a proposal was developed for an open source/standard e-commerce/telecommunications platform which would cater for the research focus associated with the two COEs. The Dwesa rural area was chosen as an appropriate location for the project, because of the ties it had previously formed with the Rhodes University Anthropology Department (which provided extensive background knowledge on Dwesa). The Dwesa area also provides an ideal environment representing marginalised communities to field test the e-commerce platform prototype. Finally, the Dwesa Development Board was presented with the ICT project to create awareness of the proposed project, in an attempt to achieve project buy-in from them, as they tend to influence the participation of the community in development activities.

2. **Project Feasibility (November 2005)**

   The project feasibility stage focused on determining an appropriate physical location for the ICT project within the Dwesa community. Initially, the nature reserve offices had been chosen as they had sufficient project infrastructure requirements. The project location, however, was later changed to the local shop (Mr Mbola's shop), because of political factors at the nature reserve. Unfortunately, Mr Mbola's expectations of the project were dashed when Telkom failed to install the VSAT on the scheduled day. The project team therefore had to explore the community further for another location for the project. Six local schools and a clinic were explored as potential project sites. Ultimately, Mpume Primary and Junior Secondary School (Figure 13) was chosen as a base for the Dwesa ICT project. The community was also explored in November, to introduce the project team to community members, and to get a feel for social, cultural and economic activities existing in the community.

Figure 13: Mpume Primary and Junior Secondary School

3. Technology Introduction and Training (January – March 2006)

This phase focused on introducing the technology to the community, and training for its use. The computers were set up at Mpume School, and the training was centred on teachers, who would eventually play a role in training community members when the project team was away (train-to-train methodology). Training was divided into *initial training* (introductory training), and *technology competence training*. Initial training provided an introductory computer literacy course to give the teachers a feel and understanding of what computers are, and their potential in enhancing the education process; therefore improving the teachers' confidence in using the computers (not necessarily competence). Subsequently, technology competence training was mainly associated with enabling teachers to become competent in using Edubuntu applications, especially Open Office. The project champions eventually assisted in training the community (Figure 14).

In addition to training, a GPS (Global Positioning System) survey was conducted (feasibility for Projects C and D), and the e-commerce music component (Project G) of the project was introduced to the community. In order to create community awareness of the project, the project team visited other schools to present the project, in particular, Nqabara Secondary school.

Figure 14: The Project Champions assisting in Community Training

4. Community Buy-in (April – May 2006)

The community buy-in phase relates to the promotion of community participation in driving the sustainability and success of the project. A memorandum of understanding was presented at a community meeting (Figure 15) to outline the commitment and support of the project team for the Dwesa ICT project, and the commitment (requirements) needed from the community to support the project. In addition to the community meeting, the project team also visited Ntubeni School to encourage the teachers to attend training. Subsequently, the project team met with all the local ICT project representatives in the community consisting of the two project champions, Headmaster, and two community representatives. Communication would be maintained between the project team and local ICT project representatives who make important decisions regarding the successful operation of the project in the community.

Figure 15: The Community Meeting with a Presentation by Mrs Gxarisa (Project Champion)

5. Technology Implementation and Community Needs Review (May – August 2006)

The VSAT was installed at this stage, and the WiMAX installation was tested for a future network between the community schools. Furthermore, the teachers were trained on how to make use of the Internet, and how to connect the computers to the VSAT and log-on for

Internet access. This phase of the project also focused on interaction with local entrepreneurs who could potentially exploit the ICT services provided to support their business, as shown in Figure 16.


Figure 16: Interviewing Local Crafts People

6. **The Proposed Close-Out**

   This phase is associated with handing over the project to the community. Currently no exiting strategy exists for the Dwesa ICT project, as it assumed that it is not an immediate issue to address, given the fact that it is an on-going and comprehensive research project at the two universities.

6.2.8 The Uses of ICT by the Dwesa Community

6.2.8.1 Current Uses of ICT in the Dwesa Project

The Dwesa community has made use of the ICT services with which they have been provided, as follows (a detailed discussion can be found in Appendix E):

Entrepreneurial Activity and Market Access: The indigenous Xhosa traditional dancers at Dwesa have attempted to use the Internet to search for information on how they could advertise themselves more effectively. Furthermore, traditional crafts people have received training in an attempt to find out where they could sell their products and at what price, in order to make a good profit in the tourism market.

Access to Education and Knowledge: The teachers at Mpume School have used the computers to enhance the learning process and improve the education process. They have used Wikipedia and the Gutenberg Project, educational games for junior and senior students, the Open Office Suite for school administration, and the Internet to search for educational information.

Rural Empowerment and Participation: Rural communities need to participate in decisions (with government, and public and private institutions) that influence their welfare. The Dwesa community has made use of the ICT project services through enquiring about the delayed compensation for pigs destroyed by the South African Department of Agriculture as a result of Swine fever, submitting work related problems to the Department of Education (DOE), following up on remittances and pensions owed by government and private institutions, and applying for government funding in rural development projects.

Establishing Community Networks: Currently, a network connection using WiMAX has been setup between Mpume School and Ngwane School, which are located in different rural communities in Dwesa. This has enabled communication between the schools, hence potentially increasing social capital and bringing the communities together in activities aimed at developing tourism and other rural capital assets.

Rural Development Administration: The community often hold meetings to discuss development initiatives. The computers at Mpume have been used by one of the committee members of the community to store information and manage community finances using Calc.

6.2.8.2 Planned Future Uses of ICT

WiMAX Networks with Schools: The project team aims to network other schools with Mpume, including Nqabara, Nondoma, and Mtokwane. These schools will eventually be networked to communicate via telephone using VoIP.

Tourism Development: The e-commerce platform could potentially improve the current tourism operation in Dwesa (for example, booking online). Furthermore, community participation in tourism development could be enhanced through, for example, collaborating with the reserve to determine how many tourists are expected to arrive during a certain period, so as to market their products effectively.

Integrating computer lessons into the school curriculum: The project champion at Mpume School plans to approach the DOE to request assistance in integrating computer lessons into their curriculum.

Local Xhosa Wikipedia for Dwesa: This will promote local content development and gather information that contributes to cultural and heritage knowledge (tourism) in the community.

The BingBee Project: BingBee is an information kiosk that provides access to information via a touch pad, and a computer behind a secure window (Wentworth, 2006: 1). This will promote access to ICT services during school holidays and weekends.

6.2.9 The Challenges to ICT Use and Implementation

The challenges faced in the project can be categorised into those faced by the community (use of ICTs), and those faced by the project team (implementation of the ICT project) (a more detailed description of each challenge can be found in Appendix E).

6.2.9.1 Challenges Faced by the Community

Infrastructure Access: These challenges are associated with the factors that have limited the effective operation of the ICT applications available:

- The computers are currently stored in the Mpume headmaster's office because the designated room for a potential telecentre is not secure enough as it lacks a burglar-barred door. As the computers are reconnected each day, the computer cables have been damaged.
- The VSAT that was installed by Telkom was delayed by five months. Furthermore, occasionally the VSAT would not work, possibly because of an inconsistency in electrical power at Dwesa. Inconsistency may have also resulted from an issue at national level.

Illiteracy and Education: Illiteracy is a major problem in rural areas. Training in Dwesa seems to have been limited to those who can read and write. Furthermore, less educated community members assume they are unable to use the computers.

Content and Language: Although the Edubuntu operating system has a Xhosa version, the teachers preferred to be trained using the English version. Therefore, when the teachers trained the community, they often had to translate in the computer content to Xhosa, which proved to be quite difficult with computer terms. Furthermore, the project team only provided training material in English, which limited some trainees who may want to refer to the material themselves directly.

Insufficient Training and Capacity Building: The challenges associated with training are similar to those associated with illiteracy, language, and content. Training also tended to focus on what was appropriate for teachers, who were more educated and experienced, which was not characteristic of most people in Dwesa. The approach to training was also quite sporadic with limited structure, which was a challenge for both trainers and trainees. Furthermore, there tended to be a lack of commitment to training, as depicted in Figure 17, where 48 people have only received training 1 to 3 times, 25 received 4 to 10 times, and 10 received training more than 10 times. This may have resulted from a lack of awareness of community members on how they could integrate the ICT to support their rural livelihood activities.

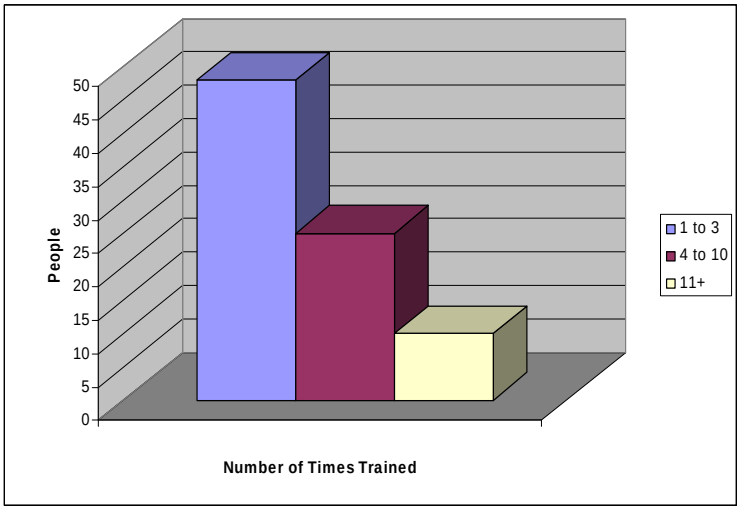

Figure 17: Bar chart of the Number of Times Community Members have Received Training

Financial Constraints: The project at this stage is donor dependent. The project team has, however, started promoting independence in the community through giving them the responsibility to raise funds for a printer.

Political Constraints: The Dwesa Development Board has attempted to skip Mpume School on the development agenda, as they assumed the computers they were provided with were for the exclusive use of the school, and not the community as a whole. Nevertheless, the project champion managed to convince the Board otherwise. The location of the project was also originally constrained by reserve manager, as he unnecessarily restricts community intervention in the nature reserve.

Social and Cultural Challenges: Some of the community stakeholders of the project have been reluctant to get involved in the ICT project as a result of social and cultural factors. These challenges include:

- Reluctance by middle aged to elderly community members to use ICT services provided, due to their assumption that the project is meant for younger people.
- Technophobia is a challenge as some community members feel intimidated by the new technology.
- Reluctance among some teachers to assist in the community project while the project team was away.
- Reluctance by some community members because of being misinformed by a teacher that the ICT project was only meant for people who had at least completed their Matric.
- A passive attitude toward development in the Dwesa rural area
- Limited available time for some community members to receive training
- Reluctance to trust other community members to train, besides the teachers

Access to Computers during Weekends and School Holidays: Training is unavailable during these periods because the school is closed and the project champions are unavailable to provide access to the school.

Incentive for Community Trainers: The project champions mentioned that there are a limited number of trainers available, which is quite challenging as they occasionally have to train many people, sometimes up to 8pm in the evening. An incentive may need to be introduced to encourage the youth and other community members to assist in training.

Distance to Mpume School: Surrounding communities in Dwesa are constrained by the distance to Mpume which can take a few hours to travel to.

6.2.9.2 Challenges Faced by the Project Team and Areas for Improvement

The project team has also faced challenges associated with the implementation and management of the project in Dwesa. An interview with the project team also reveals areas for improvement they have suggested.

The Integration of Projects and Team Dynamics: A variety of distinct projects make up the Dwesa ICT project, and hence it has been a challenge to integrate the individual goals of the sub-projects with the main goals.

The Delay of the Dwesa Community to meet Project Requirements: The project champions at Mpume have delayed meeting project requirements, such as installing a burglar-barred door to house the computers in the staff room. This has damaged some cables (continuous transference of computers from the Headmaster's office to the staff room), and delayed the implementation of the music component of the e-commerce platform.

The Integration of the Project in Community Activities: The project team has found it difficult to integrate the project effectively in rural livelihood activities.

The Challenge of Language: The project team includes researchers who can speak Xhosa, which has proven to be an advantage in communicating more effectively in the community. However, some researchers cannot attend all field trip due to responsibilities at their institutions; therefore at times a translator is unavailable for project team members who are not sufficiently fluent in Xhosa.

The Short Length of Time on Field Trips: A field trip usually lasts from three to seven days. On the first few days, some people in the project team have to deal with technical problems, and hence they end up not having enough time to do planned tasks.

The Politics associated with the Nature Reserve: It has been a challenge for the project team to deal with an uncooperative reserve manager, right from the initiation of the project in the community.

The Challenge of the Community honestly communicating their Problems: Project C aims to identify the challenges the community has faced in using computers in the Dwesa project. As community members were interviewed, they seemed to not want to inform the project team of problems they have faced using the computers, but only their problems with stakeholders at the School.

6.2.10 An Analysis of the Phases of the Dwesa ICT Project in relation to the RICT-PLC Model

An analysis of the Dwesa ICT project in relation to the RICT-PLC model is discussed in the following sections. The evidence and presence ('strong', 'slight', 'weak', 'none') of each practice is summarised in a table for each phase of the RICT-PLC model.

6.2.10.1 Concept

The Dwesa project is iterative in nature; therefore practices in Concept may have been applied in other phases of the project.

The project was not planned sufficiently and the development of *simple and clear objectives* that can be communicated to the project team and community needs to be improved. However, an effort was made to understand the Dwesa community with background knowledge of Palmer, Timmermans, and Fay's (2002) research, and hence devise objectives based on the context of Dwesa. The identification of *existing rural development activities* that could be supported by the ICT project was limited to educational institutions, that is, the local schools. However, they plan to identify other activities, possibly at a later stage of the project.

The project team was *aware of the ICT policy environment* that would influence the project, particularly considering it was a Telkom (Telecommunications Company) funded project. The Dwesa project did not necessarily apply for certain licences (WiMAX) individually, as the licences fell under Telkom. Furthermore, the research students are aware of the ICT policy environment, given their field of research and educational knowledge on ICT policy.

The ownership of the project was not strongly encouraged from the early stages of the project (limited to approaching the Dwesa Development Board), but there is strong evidence at later stages that indicate *ownership was encouraged*. This was especially supported by selecting and *cultivating enthusiastic project champions*. The two main project champions significantly drove the project in the community. One of the champions is a woman, and potential champions exist that represent the youth in the community.

Evidence suggests that the project supported the notion of *choosing the right technology appropriate* for rural environments. A feasibility study was conducted to determine compatible locations to base the ICT project and appropriate applications to be installed.

Critical Success Factor	Practiced	Presence
Simple and clear project objectives	√	Weak
Using ICT to enhance existing rural development activities	√	Slight
Incorporating/Awareness of specific ICT policy influencing the project	√	Strong
Encourage local ownership	√	Weak
Choosing the appropriate or right technology	√	Strong
Cultivating an enthusiastic influential project champion	√	Strong

Table 10: A summary of the 'Concept' phase practices of the RICT-PLC applied in the Dwesa PLC

6.2.10.2 Development

The practices that exist in this phase occasionally occurred at different phases of the Dwesa project life cycle as it was iterative and incremental in nature.

There is limited evidence to support the practice of *simple and clear objectives* under the development phase. Meetings were held occasionally with the community to discuss the project's progress, but were avoided at times because the project team assumed it was too formal, and would pressurize and intimidate community stakeholders. Nevertheless, an observation of meetings did not seem to pressurize or intimidate community stakeholders. Decisions were *ad hoc* and unplanned. The deliverables of the project were not clear and planned in the duration of the project. The scope of the project is not clearly defined resulting in unplanned decisions (for example, including Nqabara School in the project – see Appendix E). Furthermore, the sub-projects were not significantly integrated to support the main goal, with limited planned delegation and accountability of deliverables. The absence of a project manager to guide the project made it difficult to delegate and monitor the accountability of deliverables.

There is slight indication to support the *holistic approach* of the project in the rural area, but particularly little evidence in relation to *identifying existing rural development activities* and organisations (limited to the school) that could benefit from the project. However, the project team assumes that focusing on the school initially would eventually reveal other rural development activities, as the school acts as a centre for community meetings.

The Dwesa project shows that *project champions were involved in planning* and decisions regarding the project in the community. In addition, the local representatives that contributed to project decisions were representative of *socially excluded groups*. Nevertheless, this was a coincidental aspect as the project team had not planned to necessarily target socially excluded groups, but did consider a champion to represent the youth. The selection of representatives was relatively sporadic, and it was not clearly defined what level of project *ownership* would be assumed by the champions and community members.

There is some evidence to show that the project team also attempted to *understand the political environment* through background research on Dwesa, and the assistance of project champions. However, they chose to avoid getting involved in local politics and left it to the champions to be accountable to their political environment. The participation of some political leaders, such as the community Chief and the Development Board was planned and encouraged to create awareness and support of the project.

Community meetings held show some evidence that the project aims to promote the *participation of community target groups* in decision making and development. Community target groups have not necessarily been identified at the current stage of the project. Nevertheless, local entrepreneurs involved in crafts have been targeted and an attempt has been made to elicit their requirements. An initial slight indication is evident of *focusing on local/demand driven needs* and an endeavour to encourage *business development and entrepreneurship for economic self-sustainability* in the future. Planning for economic self-sustainability is also slightly evident in the fact that the community champions are planning to charge for training provided, so as to raise money for a printer and other stationery. Furthermore, charging for training could also eventually act as an incentive for community members, especially the youth, to assist in training, hence a *motive and incentive for ICT job placement in the community*.

The Dwesa project displays an effort to *train and build the capacity* of local community members to use the technology applications. However, at the Development phase, there was little evidence of planning for appropriate training. No training structure was designed for the project team, nor were the teachers assisted in designing an appropriate structure to train the community. The computer applications are, however, sensitive to the educational rural environment in developing countries

(Edubuntu Open Source Platform: refer to Appendix E), which assists in training. Therefore, there is an indication that *appropriate technology was chosen*.

In relation to the sub-project objective of Project H, it is evident that the Dwesa project aims to *build on local information and knowledge systems.* However, the practices that should be applied in the Development phase have not been employed as yet.

There is little to no evidence to support planning for the *on-going monitoring and evaluation* of the project. The occasional field visits were relied upon for updates on the progress of the project. However, there was no plan or designed assessment tool to monitor and evaluate the progress of the project toward achieving its goals.

There is little evidence of planning to enhance or mitigate *ICT policy influencing the project*, given the project team's knowledge of the ICT policy environment. There is no evidence of planning to *build local partnerships* in the Dwesa community.

Critical Success Factor	**Practiced**	**Presence**
Simple and clear project objectives	√	Weak
Approaching the project in a holistic way	√	Slight
Using ICT to enhance existing rural development activities	√	Slight
Cultivating an enthusiastic influential project champion	√	Strong
Incorporating socially excluded groups	√	Weak
Incorporating/Awareness of specific ICT policy influencing the project	√	Weak
A good understanding of the local political context	√	Weak
Significant participation of community target groups in the project	√	Slight
Focusing on local/demand driven needs	√	Slight
Building on local information and knowledge systems	√	Weak
Appropriate training and capacity building	√	Weak
Existing motivation and incentive for ICT job placement in the community	√	Slight
Focus on economic self-sustainability – business development and entrepreneurship	√	Slight
Encouraged local ownership	√	Strong
Building local partnerships	×	None
Choosing the appropriate or right technology	√	Strong
On-going monitoring and evaluation of the project	√	Weak

Table 11: A summary of the 'Development' phase practices of the RICT-PLC applied in the Dwesa PLC

6.2.10.3 Implementation

The practices that exist in this phase occasionally occurred at different phases of the Dwesa project life cycle as it was iterative and incremental in nature. Given the fact that planning was relatively limited and *ad hoc*, the implementation of some tasks and activities were unplanned. Conversely, some implementation practices associated with the RICT-PLC model were applied. At this stage of the Dwesa project, not all planned activities have been implemented.

The Dwesa project team *collaborated with an already existing rural development institution*, Mpume School, which contributes to educational development. It is therefore apparent that the project aims to support the community at large, through using the school as a base for the ICT project's impact.

An attempt has been made to select local representatives as potential champions of the project, especially the youth and community members (besides the teachers). These representatives are being *cultivated as potential project champions*. Even though these representatives actually represent *socially excluded groups*, there is no evidence to show the project team has deliberately implemented tasks to promote their participation and involvement.

Continuous communication and feedback to the community and leaders about the project's progress has been maintained, particularly through collaboration with the project champions. Therefore, there is to a limited extent an indication of Implementation practices that support an *understanding of the political environment*, and *significant participation of community target groups*. Communication and accountability has *promoted local ownership* where the community has consistently collaborated at meetings to discuss aspects relating to the project. It is apparent that community members own and drive the project. Support from the community is also evident given the fact that the ICT project is housed on an *existing public facility*, the previous staff room at Mpume School.

There is evidence of the implementation of *appropriate training and capacity building*, but its efficiency was significantly influenced by the lack of a planned training structure. At this stage of the Dwesa project, most of the implementation practices of training have been applied, but there is still room for improvement in applying these practices effectively.

It is apparent that an effort was made to *select appropriate technology* to implement in Dwesa. This is especially obvious in the open source software selected, wireless technology (WiMAX) to test in rural environments, and the proposal to eventually roll out refurbished computers and a printer.

Limited evidence exists to show that *on-going monitoring and evaluation* of the project was practiced. In this case, regular reports were compiled and loaded onto a Wiki to show the project's progress. However, these reports were informal with no defined template for guidance. Project team meetings were also held to discuss the project's progress, but these were not held often enough or on a regular basis.

There is little to no evidence to show the application of implementation practices associated with the *awareness of specific ICT policy influencing the project*, *building on local information and knowledge systems, facilitating local content development, an existing motivation and incentive for ICT job placement, focusing on economic self-sustainability*, and *building local partnerships*.

Critical Success Factor	**Practiced**	**Presence**
Using ICT to enhance existing rural development activities	√	Slight
Cultivating an enthusiastic influential project champion	√	Strong
Incorporating socially excluded groups	√	Weak
Incorporating/Awareness of specific ICT policy influencing the project	×	None
A good understanding of the local political context	√	Slight
Significant participation of community target groups in the project	√	Slight
Building on local information and knowledge systems	×	None
Appropriate training and capacity building	√	Slight
Facilitating local content development	×	None
Existing motivation and incentive for ICT job placement in the community	×	None
Focus on economic self-sustainability – business development and entrepreneurship	×	None
Encourage local ownership	√	Strong
Building local partnerships	×	None
Choosing the appropriate or right technology	√	Strong
Building on existing public facilities	√	Strong
On-going monitoring and evaluation of the project	√	Weak

Table 12: A summary of the 'Implementation' phase practices of the RICT-PLC applied in the Dwesa PLC

6.2.10.4 Close-out

The Dwesa project has not reached this phase of the RICT-PLC model and therefore it is not directly evident what practices are to be applied at this stage. Furthermore, no proposed approach or exit strategy has been developed for the project.

Critical Success Factor	Practiced	Presence
Significant participation of community target groups in the project	×	None
Focusing on local/demand driven needs	×	None
Encourage local ownership	×	None
Building local partnerships	×	None
On-going monitoring and evaluation of the project	×	None

Table 13: A summary of the proposed 'Close-out' phase practices of the RICT-PLC applied in the Dwesa PLC

6.2.10.5 Post Implementation Review

The Dwesa ICT project has not reached this stage of its project life cycle; therefore CSF practices associated with this phase are not necessarily applied. Nevertheless, there is a limited indication of applying the practice of *on-going monitoring and evaluation*, as the research project has documented some results from the project, which is typical requirement of a project team consisting of students from research institutions. This may be applied in the future post implementation review of the project, if this phase is considered.

Critical Success Factor	Practiced	Presence
On-going monitoring and evaluation of the project	√	Slight

Table 14: A summary of the proposed 'Post Implementation Review' phase practices of the RICT-PLC applied in the Dwesa PLC

6.2.10.6 Additional Phases and Practices associated with the Dwesa Project

The Dwesa project life cycle differs from the RICT-PLC model, although some phases of the project life cycles are linked and similar. In this case, the Concept phase is linked to the practices associated with the 'Project Idea Generation and Concept', and 'Project Feasibility' phase of the Dwesa ICT project. The Project Feasibility phase specifically relates to the practice associated with *choosing the appropriate or right technology*, whereby an infrastructure audit is conducted to determine an appropriate location for the project in the community.

Additional practices identified and lessons learned from the Dwesa case study are as follows:

- *Involve or delegate to the project champions or community representatives the development of a training structure for community training, once they have received sufficient training from the project team.* The project champions and local representatives in Dwesa are more familiar with an appropriate way to train the community, as they have closely experienced and observed the challenges faced by the community. This practice may relate to the Development phase and may also be associated with the critical success factor of 'appropriate training and capacity building' under this phase.
- *Significantly involve the community in determining an appropriate business model to keep the project economically sustainable.* The community representatives are more aware of the financial constraints and affordability of the community, as it is evident that they have already suggested an affordable rate to charge the community for further computer literacy training. This practice may relate to the Development phase and may also be associated with the critical success factor of 'focus on economic self-sustainability' under this phase.
- *Delegate tasks to the project champions and community so that the project's progress may be monitored in relation to the accomplishment of these tasks (this keeps the community accountable).* This is evident in some research field trips to the Dwesa community, whereby the project team left tasks for the project champions to accomplish in their absence. Furthermore, a Memorandum of Understanding/Cooperation was presented to the community to inform them of their contribution needed in supporting the project. (This can possibly form part of the Implementation phase). This practice may relate to the Implementation phase and may also be associated with the critical success factor of 'on-going monitoring and evaluation of the project' under this phase.
- *Select appropriate and relevant sub-projects to support the main ICT project objective.* It is evident that the Dwesa project has various sub-projects that support the main objective of the project. This practice may relate to the Concept phase and may also be associated with the critical success factor of 'simple and clear project objectives' under this phase.
- *Develop a plan/structure to guide the integration of sub-projects throughout the life cycle, to support the main/overall ICT project.* The project manager should supervise and guide the integration of sub-projects. This was evidently weak in the Dwesa case study, especially given it was a learning process for all students and project leaders. Therefore, research field trips and the progress of the project at times were not efficient as it is not clearly defined

how to integrate the projects. This practice may relate to the Development phase and may also be associated with the critical success factor of 'simple and clear project objectives' under this phase.

- *Practice continuous communication and feedback about the progress of sub-projects toward achieving the main project goal*s. This was evident in the Dwesa case, in order to keep the project team aware of the progress of each sub-project toward achieving the main goal, as some are dependent on each other. This practice may relate to the Implementation phase and may also be associated with the critical success factor of 'simple and clear project objectives' under this phase.

6.2.11 Concluding Remarks on the Dwesa Project Life Cycle Characteristics

The researchers in the Dwesa ICT project consist of postgraduate students experiencing an ICT project for the first time, and hence the project reveals the limitations of certain project practices and areas for improvement in the management and implementation of the project. Nevertheless, there are successful aspects of the project given some techniques that have been adopted, and this has equipped and provided students with the experience and reality of rural ICT projects. The phases and practices associated with the life of the Dwesa project are related in some cases to the proposed phases of the RICT-PLC model. However, in some cases important factors have not been considered appropriately, and undermine the sustainability of the project. Nevertheless, additional aspects of the project have supported its on-going operation in the community, which could contribute to an enhanced model of the RICT-PLC.

An important aspect of the overall life cycle of the Dwesa project is that it is iterative and incremental in nature. This enables the project to be flexible enough to adapt to any changes associated with its dynamic rural environment. A rigid waterfall approach that is characteristic of the proposed RICT-PLC model may be insufficiently adaptive to significant changes in the rural environment that could influence the sustainability and success of the project. It is important to plan appropriately for an iterative approach; this is limited in the Dwesa case. Conversely, it is possible for the RICT-PLC to adopt and incorporate the iterative characteristic of the Dwesa project. More phases or sub-phases may arise to accommodate the iterative nature of the project.

6.3 The Rhodes University Mathematics Education Project (RUMEP) ICT Project – MathsNet

6.3.1 RUMEP

The Rhodes University Mathematics Education Project (RUMEP) is a Non-governmental Organisation linked to Rhodes University, with the main purpose of supporting mathematics teachers in disadvantaged schools located in the rural and peri-urban areas of the Eastern Cape. It first started in 1995. The main aim of the project is to improve the teaching and learning of Mathematics in primary and secondary schools. RUMEP therefore works with rural Mathematics teachers to develop their professional skills and their content knowledge. The approach of RUMEP is to work in partnership with teachers to (RUMEP, 2006a):

> *"inspire innovative methods of teaching which encourage children as 'active mathematical thinkers'; building on their individual skills and knowledge, encouraging them to employ their own methods to solve problems, ask their own questions, and generally make the learning of mathematics a more pleasurable and meaningful experience"*

The major components of the RUMEP intervention in Mathematics education in the Eastern Cape are summarised in Figure 18.

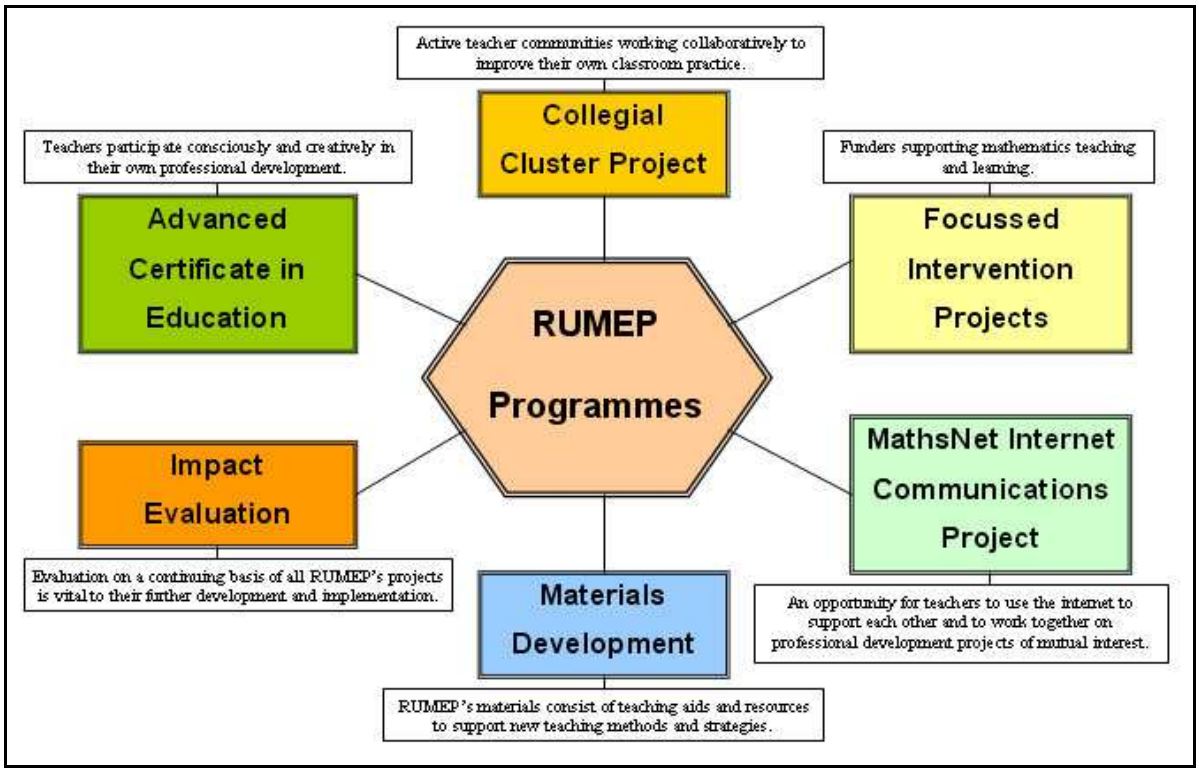

Figure 18: The Structural Components of RUMEP's Intervention (RUMEP, 2006b)

The ICT aspect of RUMEP specifically supports the Collegial Cluster Project via MathsNet.

6.3.2 MathsNet

MathsNet is an ICT project in RUMEP that supports the professional development and work of teachers in the collegial clusters. The ICTs are not the focus, but instead an enabler in the professional development process of Mathematics teachers in the Eastern Cape, to produce effective teaching resources. MathsNet began in 2002, and has so far set up computers and printers in twelve of the fifteen clusters, as shown in Figure 19. The computer icons indicate clusters at which computers have been deployed.

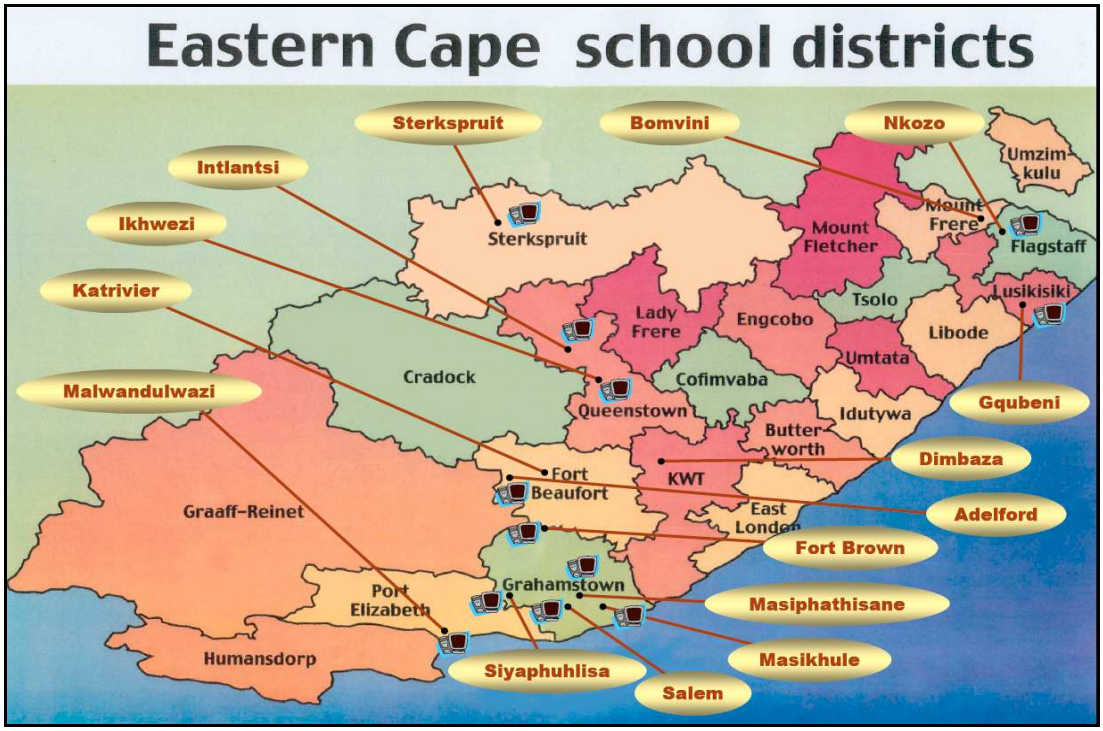

Figure 19: RUMEP Collegial Clusters and MathsNet Computer Locations (RUMEP, 2005: 37)

The MathsNet project equips teachers to create and adapt Mathematical resources for themselves, such that they can be shared for further development of other Mathematics teachers and clusters. MathsNet therefore focuses on mathematics teachers and not necessarily the development of other subjects. However, some teachers teach more that just mathematics, hence other subject areas do leverage from the ICT project.

6.3.3 The Project Context

RUMEP operates within the Eastern Cape Province of South Africa, focusing on supporting the mathematics education in the area. The Eastern Cape is known to be the poorest province in South Africa, with sparsely populated and isolated communities that exist in extremely remote areas, and a weak communications and transport infrastructure (Sainsbury and Brown, 2005b: 1).

The quality of education in the Eastern Cape has dropped in the past few years. The conditions of schools in the Eastern Cape are poor. For example, a substantial number of the schools need infrastructure repair, they have inadequate school material, the learner to teacher ratio is high (exceeding 40:1), and only 49% of learners in the province passed their matriculation examinations in 1997 (Human Sciences Research Council, 1998). Government and various development organisations have therefore developed initiatives to improve the system of education in the Eastern Cape.

RUMEP specifically focuses on enhancing Mathematics education as there has been a significant drop in the subject's pass rate, putting the province at the bottom of the country's list (RUMEP, 2006a). Mathematics education is a top priority in the Eastern Cape, as the changing democratic society of South Africa requires that students become mathematically literate to participate effectively in a technological society. Therefore, mechanisms to improve the education of Mathematics, especially in the Eastern Cape, are essential to support and contribute to education development, and hence rural development in communities (The Eastern Cape Department of Education Report, 2006).

6.3.4 The Project Stakeholders

a) The teachers who are members of each RUMEP Collegial Cluster hosting a MathsNet computer
b) The RUMEP and MathsNet project team include:
   Director: Dr Rose Spanneberg
   Courses Coordinator: Mr Tom Penlington
   Cluster School Coordinator: Mrs Fezeka Mkhwane
   Facilitator Primary Schools: Mrs Thami Tokwe
   Facilitator (FET Phase Schools): Mr Thomas Haywood
   Mathematics Lecturer: Ms Thami Mahlobo

MathsNet Facilitator/IT Consultant: Mr Mark Sainsbury

6.3.5 Project Objectives

The overall objective of RUMEP is:

- To improve the Mathematics teaching and learning in schools, especially in deep rural schools in the Eastern Cape Province, through various programmes of RUMEP intervention

The objectives of Mathsnet are:

- To promote cooperative work and professional development in the existing clusters
- To enable the creation of varied and professional teaching resources
- Enhance RUMEP's interactions with the clusters
- Add to the confidence and skills of the teachers involved with RUMEP

The goals of training and support provided by MathsNet are to develop computer skills, promote the routine use of ICT as a tool, and create a collegial professional development community.

6.3.6 The Sustainability of the ICT Project

The sustainability of the MathsNet project is crucial for it have an effective impact on a collegial cluster. RUMEP aims to promote the sustainability of the clusters, especially in relation to its supportive projects such as MathsNet. It is critical that a cluster demonstrates that it is capable of being sustainable from its first application to be in the programme, through a set of criteria that need to be met. The sustainability of the project significantly involves the responsibility of the cluster, with support and direction where necessary from the RUMEP team. RUMEP assumes that donated funds that support clusters may eventually run out. Consequently, the teachers at each cluster are trained to manage their project effectively with limited support from RUMEP. Local experts are developed in each cluster that drive and manage the project with a view to promote sustainability.

6.3.7 Project Management and Life Cycle Characteristics of the Project

The MathsNet project adopts a defined structured approach to project management. The project does not necessarily adopt a formal project management approach, but applies a structured approach that is sensitive to the project's environment, and its operation within RUMEP as a whole. The programmes in RUMEP as a whole are integrated to achieve the greater goal – the professional development of Mathematics teachers. The life cycle of the MathsNet project is applied in each individual collegial cluster.

The MathsNet project is significantly driven by the community clusters. Major decisions made in the project involve the participation of the community clusters, as they take ownership of the successful operation of the project. The management of the project is therefore guided by the needs of the community.

The MathsNet project is also iterative and incremental in nature. In this case, the needs of the project continually change as a result of the dynamic environment in which it operates. Therefore, some of the phases are repeated once a new aspect of the project is introduced. For example, the introduction of the Internet and other ICT applications (Edubuntu software) to the clusters requires repeated planning and implementation.

6.3.8 ICT Applications Used

The ICT applications and equipment used in the implementation of MathsNet at each cluster include:

6.3.8.1 Hardware

- One Computer
- One Photocopier/printer
- Four Laptops (only available during teacher training by the MathsNet Facilitator)
- Internet Connection and Access

6.3.8.2 Stationery and Material Resources

The running costs are borne by the cluster. However, they are provided initially with 2500 paper sheets and one full toner cartridge installed. The other stationery that the cluster has to obtain themselves includes:

- Paper for photocopying/printing
- Replacement toner for the photocopier
- Replacement printing drum for the printer
- Electricity costs
- Telephone costs

6.3.8.3 Software

- Microsoft Windows operating system
- The Microsoft Office Suite – Word, Excel, PowerPoint, and Access
- Microsoft Internet Explorer

6.3.9 Phases of the Deployment of the MathsNet Project at a Cluster

The phases of the MathsNet ICT project life cycle are associated with the progressive deployment of the project at community collegial clusters. A brief description of the phases of the MathsNet project is as follows (a detailed description of the phases of the project can be found in Appendix E):

1. **Cluster Project Proposal**

   This phase describes the initial proposal for a MathsNet project at a particular cluster. The potential cluster is originally given the responsibility to set up a community of teachers. RUMEP does not significantly initiate or drive this stage of the project, but leaves it to the teachers to approach RUMEP for the support of the existing community of teachers. The cluster should meet certain criteria in their application before being considered for the MathsNet project, such as having an executive committee, a cluster constitution, a bank account, and a resource centre.

2. **Cluster Assessment and Feasibility**

   This phase of the project is associated with determining the feasibility of the cluster and its resource centre for the deployment of the MathsNet project. Two assessors are sent to the cluster to carry out a feasibility survey through observing the cluster and interviewing the executive committee. The cluster is evaluated against a 'Cluster Hardware Preparedness Rating' checklist (the checklist criteria can be found in Appendix E).

3. **Pre-implementation planning**

   This phase is associated with identifying activities, tasks, and plans to allocate adequate resources for a specific cluster that has been selected for the MathsNet project. The planned activities are usually based on the feasibility evaluation carried out in the previous phase. ICT equipment needed, Internet connectivity requirements, and training requirements are planned for.

4. **Cluster Implementation**

   The planned tasks and activities are implemented in this phase of the MathsNet project. The ICT equipment is installed and the cluster committee is presented with an Electronic Agreement Form regarding the use of the equipment, maintenance, and running and replacement costs (paper, printer toner, telephone costs). The teachers are trained regularly on the use of the computers. Monitoring and evaluation is also done throughout the implementation of the project.

5. **Close-out**

   MathsNet does not necessarily have a *full* exiting strategy to hand over the project to the community. Currently, the exiting strategy they are aiming for, as long as there is still funding, focuses on equipping clusters (workshops and training) to manage themselves effectively (training, user administration, operating system administration *etc.*), and only call on RUMEP for support when needed.

6.3.10 The Uses of ICT Applications Provided by MathsNet

6.3.10.1 Current Uses of ICT

The uses are specifically associated with enhancing *education and knowledge* as the project focuses on the professional development of mathematics teachers. The collegial cluster teachers have made use of the ICT services provided by MathsNet as follows (a detailed discussion can be found in Appendix E):

Professional Teacher Development: The MathsNet ICT project supports RUMEP's collegial cluster programme in teacher training and development.

Enhancing the Mathematics Education Process: The teachers make use of the computers to develop Mathematics teaching resources to enhance the learning process.

School Administration: The MathsNet project has contributed to the enhancement of school administration in the community schools through the development of material for sports administration, assessment schedules and mark sheets, and report cards for student records.

Personal Use: The teachers are encouraged to explore other uses of the computer in their spare time, for example, for developing curriculum vitas (CV), birthday cards, and letters to family members.

6.3.10.2 Planned Future Uses of ICT

Use of the Edubuntu Open Source Platform: The MathsNet Facilitator is interested in getting ideas from the Eyethu ICT Schools Project in Grahamstown that makes use of the Edubuntu platform.

A Website for Sharing Resources and Knowledge: Recently, three clusters have been connected to the Internet. MathsNet plans to promote the sharing of knowledge and resources among clusters using the Internet.

6.3.11 The Challenges to ICT Use and Implementation

The challenges faced in the project can be categorised into those faced by the community cluster (use of ICTs), and those faced by the project team (implementation of the ICT project) (a detailed description of each challenge can be found in Appendix E).

6.3.11.1 Challenges Faced by the Community

Infrastructure Access: Some clusters are constrained by insufficient infrastructure to implement the MathsNet project. Examples of these constraints include negotiating telephone access in Department of Education offices, overdue existing telephone accounts, the high cost of installing telephone lines in rural remote areas, limited electricity connections.

Content and Language: A number of teachers struggle to use the computers because they are not sufficiently proficient in English.

Political Constraints: The resource centres for some clusters are located within local Department of Education (DOE) Offices. Some clusters have faced problems with this partnership which include, trust issues associated with office access (keys), reluctance of DOE office to share office space, and changing management that prohibits the cluster from continuing to use the offices.

Social Challenges: Some teachers at clusters are reluctant to use the computers provided by MathsNet because of time constraints and technophobia (Sainsbury and Brown, 2005a: 5).

Geographical Location: At times, teachers have to travel long distances to get to the nearest cluster.

6.3.11.2 Challenges Faced by the Project Team and Areas for Improvement

The MathsNet project team has also faced challenges associated with the implementation and management of the project at clusters.

The Challenge of Language: The MathsNet Facilitator is unable to speak the Xhosa language fluently. This becomes a challenge when training teachers who are not fluent in English, especially in understanding computer terminology. Nevertheless, the local experts have assisted the facilitator by translating where they can.

Limited Mathematics Knowledge: The MathsNet Facilitator is not experienced in teaching Mathematics, and therefore it becomes a challenge for him to give the teachers relevant Mathematics examples to practice their computer skills.

6.3.12 An Analysis of the Phases of the MathsNet ICT Project in relation to the RICT-PLC Model

An analysis of the MathsNet ICT project in relation to the RICT-PLC model is discussed in the following sections. The evidence and presence ('strong', 'slight', 'weak', 'none') of each practice is summarised in a table for each phase of the RICT-PLC model.

6.3.12.1 Concept

The phases of the MathsNet project that mainly relate to the Concept phase of the RICT-PLC model are the 'Cluster Project Proposition' and 'Cluster Assessment and Feasibility' phases.

The project is planned appropriately and especially well defined. It is clear what the objectives of the MathsNet project are for each cluster, and they are sensitive to the cluster requirements. Hence there is strong evidence of *simple and clear project objectives* set that are sensitive to the supportive need of clusters. Furthermore, it is evident that MathsNet aims to enhance Mathematics education in marginalised communities, hence *enhancing an already existing rural development activity* – education.

Local ownership is stimulated from the beginning of the project as the cluster is given the responsibility to approach RUMEP about involvement in the project. In addition, it is essential that an executive committee exists to drive the project in the cluster, with an elected convenor/chairperson. In this case, the community selects their own *project champion* (convenor), who communicates with the MathsNet project team.

There is some evidence that research is being done to *choose appropriate technology* to apply to MathsNet project, as the MathsNet Facilitator aims to mitigate infrastructure challenges. Research is also being done into the potential implementation of open source software for education.

Critical Success Factor	Practiced	Presence
Simple and clear project objectives	√	Strong
Using ICT to enhance existing rural development activities	√	Strong
Incorporating/Awareness of specific ICT policy influencing the project	√	Slight
Encourage local ownership	√	Strong
Choosing the appropriate or right technology	√	Strong
Cultivating an enthusiastic influential project champion	√	Strong

Table 15: A summary of the 'Concept' phase practices of the RICT-PLC applied in the MathsNet PLC

6.3.12.2 Development

The Development phase of the RICT-PLC model relates to the 'Pre-implementation planning' phase, and to a certain extent the 'Cluster Implementation phase.

It is evident in the MathsNet project that *simple and clear objectives* are applied in planning to allocate adequate resources to the project. Regular meetings are held with the cluster to inform and direct them in their progress towards meeting goals. Furthermore, the deliverables and accountability of the MathsNet project within meeting the RUMEP programme objective as a whole are clearly defined.

The MathsNet project is also *approached holistically,* as it considers how the ICT project itself can relate to the RUMEP programme at large and its specific influence on the effectiveness of the community cluster. The project focused on the Mathematics education at schools, therefore indicating the *use of ICT to enhance existing rural development activities*.

The community cluster significantly drives the project and its effectiveness. RUMEP encourages the participation of clusters in decisions that influence the effectiveness of the project, especially through planning for regular meetings to monitor the cluster's progress (impact evaluation, refer to Figure 18). Furthermore, the cluster is responsible for economic sustainability of the project. Therefore, it is evident that the following practices of Development are applied: *Cultivating an enthusiastic influential project champion, significant participation of community target groups in*

the project, focusing on local/demand driven needs, focus on economic self-sustainability, encouraged local ownership, and *on-going monitoring and evaluation of the project.*

It is strongly evident that an effort is made to provide *appropriate training and capacity building*. The feasibility survey initially identifies the existing computer skill level within the cluster. A training structure exists to train teachers and a continuous assessment of the teacher's skill level and needs is practiced. *Building on local information and knowledge systems* is not necessarily applicable in this case study. However, it is slightly evident that existing community structures, practices, experiences, and needs are identified, and then incorporated into the process of learning among the teachers, which helps them to grasp the computer as a tool more effectively. This is specifically promoted through encouraged local content development among the teachers in the cluster.

There is slight evidence to suggest that MathsNet is making an effort to plan for enhancing and mitigating the *influence of ICT policies* on the sustainability of the project, as the Facilitator is still in the process of researching the policy environment. For instance, the Facilitator is researching on regulations associated with using WiMAX technology for some clusters, as Telkom is currently unable (due to high costs) to install telephone lines in very remote areas.

The MathsNet project team is aware of the *local political context* surrounding the cluster, as the teachers continuously communicate the political challenges they face, especially in relation to the partnership with the DOE offices. Nevertheless, the project team relies on the cluster to deal with the challenge themselves, and may advise only occasionally.

Little evidence suggests that MathsNet has planned to *choose appropriate technology*. So far this aspect is conceptual, as the MathsNet facilitator is only currently researching alternative technologies appropriate for rural environments.

There is slight evidence to show the MathsNet project is *building local partnership*. For instance, the partnership with the DOE offices seems quite informal which has resulted in constraints faced by the clusters. However, the MathsNet project has managed to partner with some community schools to support the project.

There is no indication in the project of *incorporating socially excluded groups*, and an existing *motivation and incentive for ICT job placement in the community*. These factors, however, may not be applicable to the MathsNet project. The project team indicated that the clusters have not been challenged by social discrimination, and the project does not aim to create ICT job placements.

Critical Success Factor	Practiced	Presence
Simple and clear project objectives	√	Strong
Approaching the project in a holistic way	√	Strong
Using ICT to enhance existing rural development activities	√	Strong
Cultivating an enthusiastic influential project champion	√	Strong
Incorporating socially excluded groups	×	None/Not Applicable
Incorporating/Awareness of specific ICT policy influencing the project	√	Weak
A good understanding of the local political context	√	Slight
Significant participation of community target groups in the project	√	Strong
Focusing on local/demand driven needs	√	Strong
Building on local information and knowledge systems	√	Slight
Appropriate training and capacity building	√	Strong
Existing motivation and incentive for ICT job placement in the community	×	None/Not Applicable
Focus on economic self-sustainability – business development and entrepreneurship	√	Slight
Encouraged local ownership	√	Strong
Building local partnerships	√	Slight
Choosing the appropriate or right technology	√	Slight
On-going monitoring and evaluation of the project	√	Strong

Table 16: A summary of the 'Development' phase practices of the RICT-PLC applied in the MathsNet PLC

6.3.12.3 Implementation

The Implementation phase of the RICT-PLC, significantly relates to the 'Cluster Implementation' phase of the MathsNet PLC.

It is strongly evident that the community of teachers drive the project and are significantly involved in promoting the sustainability of the project. An elected executive committee that continually communicates with the MathsNet project team indicates that leadership of the cluster does not rely on only one person, which can put the cluster at risk. Furthermore, in some communities where clusters exist, the community schools have supported the MathsNet project, for example, through providing a venue for the cluster resource centre. Altogether, these aspects of the project indicate that the following factors are practiced in the MathsNet project: *using ICT to enhance existing rural*

development activities, cultivating an enthusiastic influential project champion, significant participation of community target groups, encouraged local ownership, and *building on existing public facilities.*

During implementation, the MathsNet project team initially provides the cluster with enough material to start, but the economic sustainability (replacement costs for material) relies on the local management of the cluster. Therefore, it is evident that MathsNet focuses on promoting *economic self-sustainability.*

The practices associated with *appropriate training and capacity building* are strongly evident in the MathsNet implementation phase. *Local content development* is facilitated and promoted among the teachers, to create their own teacher resources with the support of ICT applications. As mentioned earlier, *building on local information and knowledge systems* may not necessarily be applicable to the MathsNet project. However, to an extent, the MathsNet project does build on existing community's structures, practices, experiences, and needs that are incorporated into training (local content development encouraged in training).

A continuous process of monitoring and evaluation is carried out throughout the year to assess vital components (for example, cluster impact on teachers, teaching skills gained, cluster management and sustainability) of the project; hence it is strongly evident that *on-going monitoring and evaluation* is practiced. However, monitoring is focused on the cluster itself, and not the partnership with the DOE, to monitor their expectations of the project. Nevertheless, the partnership with the schools involved in supporting the project is monitored on an informal basis. Therefore, there is slight indication of *building local partnerships*. In addition, the political constraint surrounding the partnership with the DOE indicates a weak application of *understanding the local political context* due to a limited flow of communication regarding changes in management. However, the project team is aware of these challenges.

There is a slight indication of *choosing appropriate technology* for the MathsNet project by deploying cheaper refurbished computers for basic ICT services. However, the MathsNet project has not yet adapted/deployed open source software or freeware, which may be more appropriate for developing countries. The Facilitator is still in the process of researching the adoption of open source software.

The MathsNet project does not apply the implementation practices of *incorporating/awareness of specific ICT policy influencing the project.* The awareness of the local cluster in respect of ICT policy may not be a focus of the MathsNet project as such. Furthermore, there is no application of *incorporating socially excluded groups*, and an *existing motivation and incentive for ICT job placement in the community*.

Critical Success Factor	Practiced	Presence
Using ICT to enhance existing rural development activities	√	Strong
Cultivating an enthusiastic influential project champion	√	Strong
Incorporating socially excluded groups	×	None/Not Applicable
Incorporating/Awareness of specific ICT policy influencing the project	×	None/Not Applicable
A good understanding of the local political context	√	Weak
Significant participation of community target groups in the project	√	Strong
Building on local information and knowledge systems	√	Slight
Appropriate training and capacity building	√	Strong
Facilitating local content development	√	Strong
Existing motivation and incentive for ICT job placement in the community	×	None/Not Applicable
Focus on economic self-sustainability – business development and entrepreneurship	√	Slight
Encourage local ownership	√	Strong
Building local partnerships	√	Slight
Choosing the appropriate or right technology	√	Slight
Building on existing public facilities	√	Strong
On-going monitoring and evaluation of the project	√	Strong

Table 17: A summary of the 'Implementation' phase practices of the RICT-PLC applied in the MathsNet PLC

6.3.12.4 Close-out

This phase relates to the 'Close-out' phase of the MathsNet PLC. There is no full exiting strategy that exists for MathsNet. However, they have a proposed strategy that is in the process of being further developed.

The close ties trust (encouraged ownership) that MathsNet has with the community clusters and the on-going monitoring practiced indicates that the project aims to promote *significant participation of community target groups in the project*, *focus on local/demand driven needs*, and apply *on-going monitoring and evaluation* (through on-going support from RUMEP) of the project once it is completely handed over to the community. However, it is not clearly evident in the proposed

strategy that MathsNet aims to confirm continuing *partnerships* to promote sustainability, before closing the ICT project.

Critical Success Factor	Practiced	Presence
Significant participation of community target groups in the project	√	Slight
Focusing on local/demand driven needs	√	Slight
Encourage local ownership	√	Slight
Building local partnerships	×	None
On-going monitoring and evaluation of the project	√	Slight

Table 18: A summary of the proposed 'Close-out' phase practices of the RICT-PLC applied in the MathsNet PLC

6.3.12.5 Post Implementation Review

The MathsNet ICT project has not reached this phase of the project life cycle. However, the CSF of *on-going monitoring and evaluation* of the MathsNet project is considered as reports and publications of the lessons learned are produced to share with similar ICT projects. Therefore, a slight indication exists to apply a post implementation review of project in the future.

Critical Success Factor	Practiced	Presence
On-going monitoring and evaluation of the project	√	Slight

Table 19: A summary of the proposed 'Post Implementation Review' phase practices of the RICT-PLC applied in the MathsNet PLC

6.3.12.6 Additional Phases and Practices associated with the MathsNet Project

Most of the phases and practices of the MathsNet project life cycle and the RICT-PLC model are similar. However, there are additional phases and practices associated with the way the project progresses.

The Concept phase of the RICT-PLC is divided by the MathsNet project into two distinct phases, that is, 'Cluster Project Proposition' and 'Cluster Assessment and Feasibility'. There are distinct practices that fall under each of these phases, rather that having them all defined under the Concept phase. In this case, the specific practices in the MathsNet project that fall under 'Cluster Assessment and Feasibility' consider the following practices:

- *Delegate assessors in the project team to conduct a feasibility survey* of the possible project location. This will ensure that the criteria that need to be met by the cluster are sufficient, through observations and interviews by the project team assessors.
- *Develop a checklist or assessment document* on which to base the feasibility survey.
- *Conduct an infrastructure audit* to assess the potential location of the ICT project.
- *Conduct a computer skills audit* to assess the current computer literacy skill in the community, and identify the training requirements of the community cluster.

An additional practice identified from the MathNet case study is:

- *Involve the community in the selection of a project champion to drive the community project*. The community is familiar with its residents, and hence they are more aware of the capability of specific community members in driving the project. This practice may relate to the Concept phase and may also be associated with the critical success factor of 'cultivating an enthusiastic influential project champion' under this phase.

6.3.13 Concluding Remarks of the MathsNet Project Life Cycle Characteristics

The MathsNet project life cycle differs from the RICT-PLC in some characteristics associated with its approach to progressively managing the project to promote sustainability. Therefore, there are additional aspects of the project that promote its sustainability in the cluster, which could contribute to an enhanced model of the RICT-PLC.

The MathsNet project life cycle is also iterative and incremental in nature. This enables the project to be flexible enough to adapt to any changes associated with its dynamic rural environment. In this sense, before the project is handed over to the community cluster, there are additional sub-projects that continually build up the MathsNet project over time to become sustainable and effective in the professional development of the Mathematics teachers. For example, the Internet project was only introduced in 2005, with MathsNet having begun in 2002. MathsNet therefore had to incorporate this change into its cluster projects. Therefore, it is necessary for the project to be flexible enough to adapt to changing requirements of the project.

6.4 Conclusion

An investigation of the Dwesa and RUMEP (MathsNet) ICT projects provides a real-life application of the life cycle through which a rural ICT project progresses. The Dwesa ICT project is a relatively

immature project compared to the RUMEP MathsNet project which has been operating over a number of years. The two projects differ in their approach to promoting the sustainability of the project in the community, depending on the main objectives and uses of the ICT project. The project management and life cycle characteristics are similar in their iterative nature, but still differ significantly in structure and detail. This provides different perspectives on the practices and phases applied in a project to promote its success and sustainability within the rural community. An analysis of the projects also reveals that there are challenges to ICT use in the community, and challenges that the project team is faced with relating to the management and implementation of the project. Where possible, these challenges need to be mitigated by applying the appropriate practices to the project situations.

Finally, an analysis of the phases of the case study project life cycle, in relation to the RICT-PLC model provide a comparative analysis of the theoretical model to that of a real-life rural ICT project situation. The analysis shows that many of the practices and phases contained in the RICT-PLC model are evident in the case studies. The mature RUMEP MathsNet project (more experience and best practice) manifests best practices than the Dwesa ICT project. Additional characteristics and practices from each case study complement and could form the basis of enhancements to the RICT-PLC model.

Chapter 7

An Enhanced Model of the RICT-PLC for Sustainable Rural ICT Projects

Chapter Six explored two rural ICT project case studies. This chapter revises the existing proposed RICT-PLC through the adoption of additional characteristics and practices identified in the case study analysis and research review.

7.1 Introduction

An exploration of existing rural ICT projects reveals additional characteristics and practices applicable to a realistic dynamic rural environment. The analysis of the two case studies confirms some of the phases and practices of the theoretical RICT-PLC model. However, additional features identified in the case study analysis can inform an enhanced model of the RICT-PLC, which is more relevant in a dynamic rural project environment. The aim of this chapter is to revise the existing proposed RICT-PLC through the adoption of additional characteristics and practices identified in the overall research review and case study analysis.

The chapter first provides a general reflection and comment on ICT projects for rural development, revealing key aspects that have been identified in the research investigation. Additional phases and practices are then described and specified under each phase of the original RICT-PLC Model. In summary, a graphical representation is presented to illustrate the enhanced RICT-PLC model for sustainable rural ICT projects. Finally, the chapter findings are summarised and it is concluded that enhanced RICT-PLC model provides a proposed guideline for ICT project management in rural areas to support sustainable ICTs for rural development.

7.2 A Reflection of ICT Projects for Rural Development

Rural development is a vital element in rural areas, as it contributes significantly to equipping people to improve their community and economic activities. ICT projects support and enable rural development activities. A review of the literature and an investigation of existing rural ICT projects reveal that particular aspects of rural ICT projects differ significantly from typical ICT projects in industry. In a nutshell, the three key aspects that need to be considered in rural ICT projects and applied in a rural context, are that the project i) needs to be community-driven, ii) needs to be preceded by a pilot project, and iii) is iterative and incremental in nature. This promotes the impact and sustainability of the project in the rural community.

Firstly, it is apparent that rural ICT projects need to be significantly *community-driven*. This particular aspect drives the success and sustainability of the project through community buy-in. Rural areas are typically faced with challenging issues associated with high levels of poverty and slow rates of development. Consequently, there are more urgent development issues that rural communities believe should be addressed, such as low agricultural productivity, environmental

degradation, unsustainable population growth, the HIV/AIDS pandemic and high disease burdens *etc*. It is not easily obvious and immediately apparent what the actual benefits of an ICT project are for a community as an enabler of development, and this may threaten the sustainability of the project. Initially, the community may be enthusiastic about the introduction of an innovative project, but may eventually become sceptical and reluctant to embrace the project if they are not immediately aware of the potential benefits of ICT as an enabler of rural development. The community needs to realise the importance of the project in supporting rural development, before they are willing to apply it to their rural livelihood activities. Rural communities in developing countries are community-oriented societies, therefore, the community needs to see how the project can benefit the rural community at large, in order for them to accept and support the project together (IDRC, 2003: 32). Furthermore, the project team needs to be sensitive to the constraints to ICT use faced by the community, so that action can be taken to mitigate these constraints. Sustainability and success of the project therefore relies on the ability of the community to own, drive and integrate the ICT project in rural development activities. In this way, the project eventually becomes relevant to the rural community in supporting activities toward alleviating poverty. Community involvement is critical from project initiation to project close-out, and hence forms a significant part of the overall implementation of rural projects.

Secondly, the acceptance of an ICT project in a rural area is not instantaneous in the short-term, as the community is not particularly familiar and confident with the technology. The community at large needs to realise the benefits and potential of the project, before they are willing to participate in the project. Therefore, ICT projects that aim to support more than one rural development activity should initially implement the project in smaller components at an experimental level. This allows the community to experiment with the project progressively and realise the actual benefits of using the technology. For example, an ICT project could be initially implemented at the community school, whereby the focus of the project would be to enhance education at the school. Eventually, the teachers who have been trained may be encouraged to train community members who have shown interest in the technology from which the school has benefited. This motivates the community to explore more uses, with guidance from the project team to effectively integrate ICT uses into their rural livelihood activities that contribute to rural development. A *pilot project* will expand depending on the local demand driven requirements, hence supporting other areas of rural development. The rural ICT project ultimately develops into an adaptive project that adapts to the dynamic rural environment, as the community buys-in to the project.

Thirdly, it is manifest that rural ICT projects are characterised as *iterative and incremental* in nature. As the community begins to show an interest in the ICT project, local demand driven needs of the community result in the development of sub-projects that augment the effective use of ICTs for rural development activities. The community could take advantage of typical uses of ICT and reveal the constraints with which they could be faced in using ICTs. A project team with previous experience may be more aware of these uses and challenges. Nevertheless, demand driven needs and other arising challenges associated with use and implementation may not be easily evident during the early stages of the project. Therefore, the uncertainty and complexity of the rural environment implies that a project needs to be flexible enough to adapt to changing requirements and constraints of the ICT project. A traditional waterfall project life cycle approach (like the proposed RICT-PLC) is commonly characterised by the initial development of requirements that remain frozen and completely locked before further phases of ICT project implementation take place, hence limiting the flexibility of the project in the community. Therefore, it would be appropriate for rural ICT projects to apply an adaptive or agile life cycle model to the implementation and management of the project. According to Highsmith and Cockburn (2001: 122 in Abrahamsson *et al.*, 2002: 12):

> *"what is new about agile methods is not the practises they use, but their recognition of people as the primary drivers of project success, coupled with an intense focus on effectiveness and manoeuvrability."*

The aspects that make the life of a project adaptive and agile are when it is (Abrahamsson *et al.*, 2002: 17):

- Incremental – small ICT project releases with rapid cycles
- Cooperative – the rural community and project team work closely together with close communication
- Straightforward – the method itself is easy to learn and to modify, and it is well documented
- Adaptive – able to make last minute changes

An adaptive iterative project which is characteristic of rural ICT projects, it is essential that they are planned appropriately. An iterative plan is (Kruchten, 2002):

> *"a fine grained, time-boxed plan; there is one per iteration. As each Iteration Plan focuses on only one iteration, it has a time span small enough to let the planners do a good job of detailing tasks with the right level of granularity and allocating them to appropriate team members."*

A project usually has two iterative plans that should be 'active' at any time (Kruchten, 2002):

- A plan for the *current iteration*, to track the progress for the iteration that is underway,

- A plan for the *next iteration*, which is built toward the second half of the current iteration and is ready at the end of it.

While the project team is executing the current iteration, the project manager needs to act quickly, to modify the plan for the next iteration in relation to the changing requirements of the project (aided by monitoring and evaluation). Furthermore, the project manager needs to apply the following practices, when building an iteration plan (Kruchten, 2002):

- *Determine the iteration scope:* This determines the intent and what is to be accomplished in each iteration
- *Define iteration evaluation criteria:* Defines how to objectively evaluate the deliverable or accomplishments at the end of each iteration
- *Define iteration activities:* establishes what work needs to be accomplished for iteration deliverables
- *Assign responsibilities:* Allocate resources to execute the project activities defined.

Using an adaptive life cycle model for rural ICT projects could possibly promote the sustainability of the project as it adaptively strives to meet local requirements and consider the critical success factors of rural ICT project sustainability.

7.3 Revisions to the RICT-PLC Model

The initial RICT-PLC model is adapted from the traditional project life cycle, and consists of the phases: Concept, Development, Implementation, Close-out, and Post Implementation Review. The practices that fall under each phase originate from the critical success factors of sustainability that were identified from a review of project case studies from development organisations. These critical success factors derived from literature reveal the lessons learned and good practice for the success or sustainability of rural ICT projects. An investigation of two existing rural ICT projects, Dwesa and MathsNet, apply the model in a rural context. However, additional aspects, phases, and practices from these two projects contribute to an enhanced RICT-PLC model. Furthermore, it is also apparent that some practices are not applicable to a particular project, which may result from differing project contexts, objectives and scope. The specific revisions to the phases and critical success factor practices are now presented.

7.3.1 Concept Phase

The Concept phase can be divided into two distinct phases, namely, Project Idea Generation and Project Feasibility, as illustrated in Figure 20.

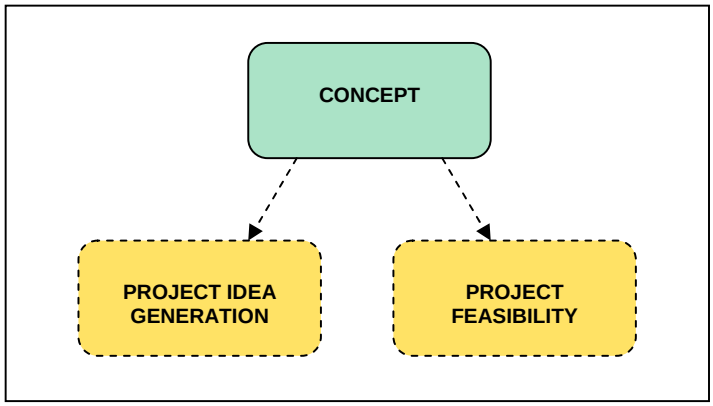

Figure 20: A Breakdown of the Concept Phase for the enhanced RICT-PLC Model

Although Project Idea Generation and Project Feasibility relate to the Conceptual stage of a rural ICT project, they are unique in their focus and practices applied:

- **Project Idea Generation:** This phase of the project is associated with generating a proposal for the project, which defines the needs and concepts that underlie the project. A high level plan for the rural ICT project is developed to define this need for the project in supporting rural development activities. Ideas for the ICT project are recorded in a brainstorming session among the project team and community members, where problems and potential solutions are identified and defined (Kerzner, 2003: 383). The key result of this phase is a defined proposal for a rural ICT project in a community, without necessarily determining a feasible location for the proposed project. The original CSF practices that fall under Concept apply to this phase, except for the CSF of *'choosing the appropriate or right technology'* which applies to Project Feasibility. Additional practices that could also be considered in this phase of the project of the RICT-PLC model are:
    - *C1. Simple and clear project objectives*
        - Select appropriate and relevant sub-projects to support the main ICT project objective
    - *C4. Cultivating an enthusiastic influential project champion*
        - Involve the community in the selection of a project champion to drive the community project
- **Project Feasibility:** This phase of the project is associated with assessing and determining the feasibility of the community as an appropriate location for the ICT project. On a small scale, this also involves assessing the proposed location/public facility in the community. A feasibility study is necessary to evaluate the viability of the project (alternative

conceptual solutions, and benefits and costs of the project), especially with regard to supporting rural development activities in the community. The involvement of community members is critical in the feasibility study, as they provide much of the required effort and information, and are able to judge the impact of alternative approaches to the project. The practices that should be incorporated into this phase include:

- *Delegate assessors in the project team to conduct a feasibility survey* of the possible project location. This ensures that the criteria that need to be met by the cluster are sufficient, through observations and interviews by the project team assessors.
- *Develop a checklist or assessment document* on which to base the feasibility survey.
- *C11. Appropriate training and capacity building*
  - Conduct a computer skills audit to assess the current computer literacy skill in the community, and identify the training requirements of the community cluster.
- *C17. Choosing the appropriate or right technology*
  - Research the rural environment's existing ICT infrastructure and its compatibility with new ICT (conduct an infrastructure audit)

7.3.2 Development Phase

The Development phase of the RICT-PLC model was quite similar and applicable to both case studies. However, in both case studies, this phase was iterative and incremental in nature. The additional practices considered in this phase include:

- *C1. Simple and clear project objectives*
  - Develop a plan/structure to guide the integration of sub-projects throughout the life cycle, to support the main/overall ICT project
- *C11. Appropriate training and capacity building*
  - Involve or delegate to the project champions or community representatives the development of a training structure for community training, once they have received sufficient training from the project team

- *C14. Focus on economic self-sustainability*
  - Significantly involve the community in determining an appropriate business model to keep the project economically sustainable

7.3.3 Implementation Phase

The Development phase of the RICT-PLC model was similar and relevant to both case studies. This phase was also iterative and incremental in nature. The additional practices considered in this phase include:

- *C1. Simple and clear project objectives*
  - Practice continuous communication and feedback about the progress of sub-projects toward achieving the main project goals
- *C19. On-going monitoring and evaluation of the project*
  - Delegate project guidance tasks to the project champions and community so that the project's progress may be monitored in relation to the accomplishment of these tasks (this keeps the community accountable)

7.3.4 Close-out Phase

Additional practices associated with the close-out phase were not apparent in either of the case studies. This phase, however, appeared to be a once-off process that would not be repeated, but would occur once the main goals of the project have been achieved.

7.3.5 Post Implementation Review Phase

Additional practices associated with the post implementation review phase were not apparent in either of the case studies.

7.3.6 Iterative and Incremental Nature

The two phases that can mainly be influenced by the iterative nature of rural ICT projects are the Development and Implementation phases. These two phases are not necessarily fixed, but are dynamic in the progressive life of the project, before the ICT project is handed over (Close-out) to the community. A number of iterations (iteration0, iteration1…) can exist in a rural ICT project, which depend on the project's objectives and scope. The first iteration (iteration0), in particular, should be associated with an experimental pilot project deployed in the rural community. Subsequently, the ICT project is increasingly built on throughout the progressive development of the

project, which is sensitive to the rural environment. The iterative process is significantly driven by monitoring, evaluation and reflection against the project plans, as the project progresses. This aids in modifying subsequent iteration plans in relation to the changing requirements of the project.

7.4 A Summary of the Enhanced Model

A reflection of the key aspects that need to be considered in a rural ICT project, and additional revisions to the proposed model, contribute toward an enhanced model of the RICT-PLC for sustainable rural ICT projects. The original proposed RICT-PLC model is presented again for comparison in Figure 21. The enhancements to the RICT-PLC model are graphically represented in Figure 22.

The enhanced RICT-PLC model consists of six phases: Project Idea Generation, Project Feasibility, Development, Implementation, Close-out, and Post Implementation Review. The Development and Implementation phases are iterative and incremental in nature, aided by monitoring, evaluation and reflection. The community needs to participate significantly in the project and drive it from its early stages to post implementation review, to promote ICT project sustainability in the rural area.

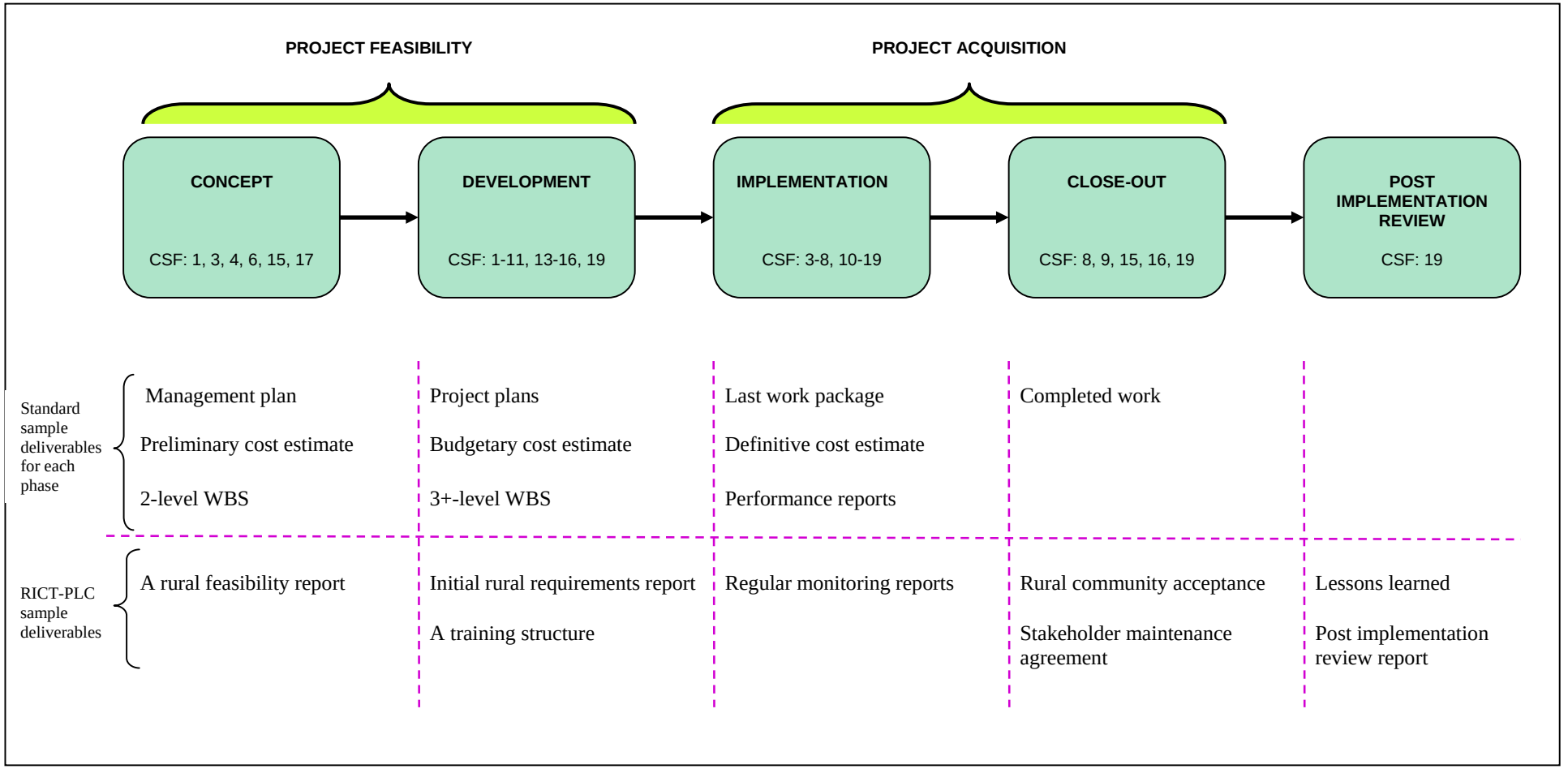

Figure 21: The Original Proposed Rural ICT Project Life Cycle (RICT-PLC)

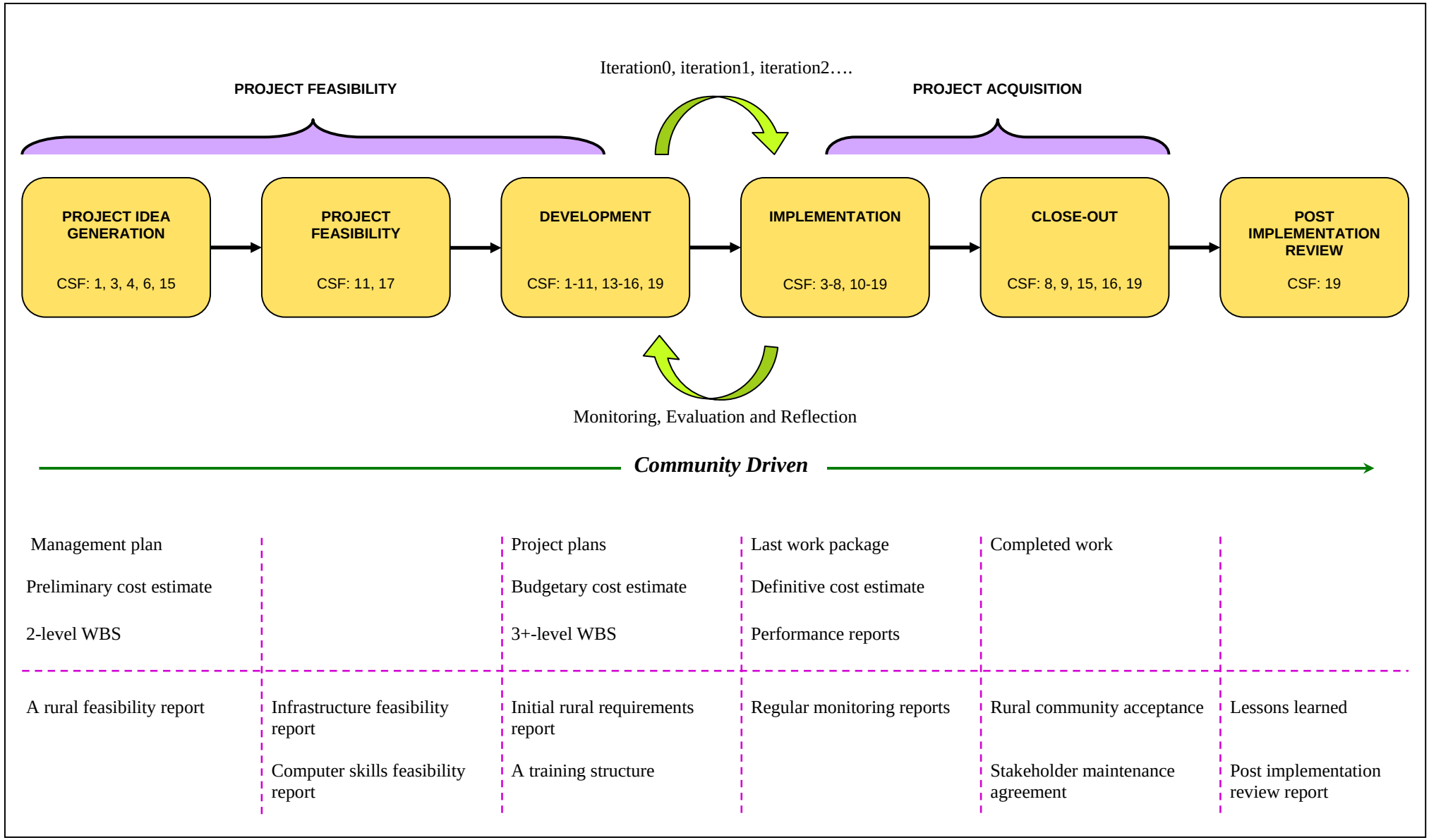

Figure 22: The Enhanced Rural ICT Project Life Cycle (RICT-PLC) Model

7.5 Conclusion

ICTs play a significant role in supporting rural development, and therefore it is important to understand the most appropriate way of deploying ICT projects in rural communities. A reflection of the overall research, specifically consisting of a literature review and case study investigation, indicate that there are key aspects to consider in promoting rural ICT project sustainability. These aspects are that rural ICT projects should be community driven, be initiated with a pilot project in the community, and are iterative and incremental in nature. Additional phases and practices identified in the case study investigation contribute to revisions of the RICT-PLC model. The proposed enhanced RICT-PLC model encapsulating the relevant CSFs provides a proposed guideline for ICT project management in rural areas to support sustainable ICTs for rural development.

Chapter 8

Conclusion and Future Research

Chapter Seven presented an enhanced model of the RICT-PLC for sustainable rural ICT projects. This chapter concludes the overall research investigation. The contributions of the thesis are indicated and future research is identified.

8.1 Introduction

Rural development is an important target today for developing countries. As a result, government and development organisations continue to explore and attempt to apply the most effective mechanisms for promoting rural development. Information and knowledge play significant roles in development, and therefore Information Communication Technologies act as enabling tools in rural development. It is vital to deploy *sustainable* ICT projects in rural environments, so that these tools can extensively support effective rural development. This research investigated the development of ICT project management techniques for sustainable rural ICT projects. This chapter concludes the overall research investigation. The contributions of the research are presented, after which areas for future research are proposed.

8.2 Contributions of the Research

The research study contributes to knowledge of ICT for rural development as follows:

A Review of ICTs for Rural Development

- *Developing countries strive to expand growth and development* in their countries, in order to alleviate the challenges of poverty and deprivation. Poverty that exists in the world today is predominantly rural, as three quarters of the world's poor, 900 million people, live in rural areas. Consequently, rural development reflects upon meeting development goals as a country can focus on addressing the rural poor who are fundamental to accelerating the development process.
- *Information and knowledge are key in rural development* as they provide rural people with the ability to expand their choices through knowing what works best in their communities, hence contributing to development, competitiveness and productivity.
- *ICTs that aid in the communication of information and knowledge for rural development, and are therefore used for* entrepreneurial activity and market access, access to education and knowledge, addressing health challenges, rural empowerment and participation, addressing environmental sustainability, and establishing community networks
- *The challenges to ICT use identified* include infrastructure access, illiteracy, content, education levels, insufficient training and capacity building, financial constraints, political constraints, and social and cultural constraints.

The Meaning and Application of ICT Project Sustainability in Rural Areas

- *The sustainability of a project forms a substantial part of the positive impact and success of ICT projects in rural communities*. Rural ICT projects can fail at different levels due to challenges to ICT use and implementation, where partial failure is especially associated with projects that are unsustainable.
- *Sustainability can be categorised* into social and cultural, institutional, economic, political, and technological sustainability. Critical success factors of sustainability identified from lessons learned and good practice are classified under each category of sustainability.
- The *critical success factors of sustainability* show that the effective implementation of ICT projects in rural areas rely mostly on human/user (community oriented) factors related to social, political, cultural and economic influences. These factors need to be incorporated into ICT project management and implementation in rural areas.

The RICT-PLC model is described as follows:

- *A proposed theoretical Rural ICT Project Life Cycle (RICT-PLC) model* views rural ICT projects as a series of inter-related phases that promote project sustainability in a complex rural environment (sensitive to rural society, economic, and technological environmental issues). The RICT-PLC model incorporates the critical success factors of sustainability, hence linking project management and rural ICT project sustainability. The CSFs of sustainability are incorporated under each phase of the project life cycle: Concept, Development, Implementation, Close-out, and Post Implementation Review.
- *A case study analysis of the Dwesa ICT project and the RUMEP MathsNet* confirms that many of the practices and phases contained in the RICT-PLC model are evident in the case studies. Additional phases and practices include:
  - The Concept phase can be divided into two distinct phases, namely, Project Idea Generation and Project Feasibility with specific practices under each phase
  - Additional practices were identified for specific CSFs under the Development, and Implementation phases.
- *A reflection of the review of literature and an analysis of existing rural ICT projects* reveal characteristics and practices to consider in the proposed RICT-PLC model:
  a) There are three key aspects that need to be considered in rural ICT projects:
     i. The project needs to be community-driven,

ii. The project needs to be preceded by a pilot project, and

iii. The project is iterative and incremental in nature

b) There are six phases that make up the RICT-PLC model: Project Idea Generation, Project Feasibility, Development, Implementation, Close-out, and Post Implementation Review

c) Two phases of the model are identified as iterative in nature, that is, Development and Implementation. The first iteration (iteration0), in particular is associated with an experimental pilot project deployed in the rural community, and subsequently followed by more iterations that incrementally build the project. Monitoring, evaluation, and reflection are key techniques that drive the iterative process.

8.3 Future Research

8.3.1 Enhancing the Proposed RICT-PLC Model

The RICT-PLC model was developed from an extensive review of literature, and explored and enhanced through a case study investigation. The case study investigation, however, was limited to two case studies. Further exploration of other rural ICT project case studies can reveal additional characteristics (including iterative aspects), phases, and practices that can further enhance and validate the RICT-PLC model.

8.3.2 Adapting the RICT-PLC Model for Different Kinds of Rural ICT Projects

The RICT-PLC model is not necessarily equally applicable across all types of rural ICT projects, and therefore research could be conducted to customise the RICT-PLC model for particular project focuses. For instance, according to Accascina (2000), rural development can be divided into four areas of importance and analysis. These include poverty alleviation, enhancing growth and competitiveness, environmental sustainability, and democracy and human rights. The four areas identified are priority areas among development communities such as the UN, NEPAD and African Union (AU). However, poverty alleviation seems to be a focus of most studies and uplifts the three other areas of rural development (Accascina: 2000). The specific activities associated with poverty alleviation include agriculture, food and security, social welfare, gender and equity, and other livelihoods (including tourism). Rural ICT projects can therefore be associated with supporting these specific activities associated with poverty alleviation and rural development. Some practices in the RICT-PLC model may not be applicable in some projects. This will also depend on the particular uses for ICT and challenges faced in the specific rural ICT project.

8.3.3 A Maturity Model for Rural ICT Project Sustainability

Research has revealed that there are critical success factors of sustainability that need to be considered when implementing ICT projects in rural communities. These critical success factors aim to alleviate and limit the influence of the challenges associated with ICT use in rural communities. Development organisations implement ICT projects in rural areas with varying degrees of success, as they fail to take full cognisance of all CSFs. The extent to which they consider the CSFs of project sustainability therefore needs to be *assessed* so that they can be informed of the practices on which they need to focus in order to improve the ability of their projects to be sustainable and influential in a rural community. Development organisations need to be aware of their strengths and weaknesses associated with their approach to implementing rural ICT projects. A rural ICT project needs to know where it stands (maturity) through assessment and evaluation, and hence be advised of the actions to take in improving its approach to managing and implementing a rural project.

Moving toward the target of rural ICT project sustainability requires that a set of goals associated with appropriate project practice are achieved. In order to set sensible goals for a project, the concept of maturity needs to be understood and applied. Maturity models exist to improve the approach to managing and implementing ICT projects. The widely known Capability Maturity Model (CMM) developed by the Software Engineering Institute (SEI), and the Implementation Maturity Model (IMM) developed by Niazi *et al.* (2005) can be adapted to develop a model for rural ICT project sustainability. The CMM is a five-level model that lays out an evolutionary path for software process improvement in organisations (Schwalbe, 2006: 325). It attempts to quantify and present the capability of an organisation to produce high quality software products (McManus and Wood-Harper, 2003: 273). The IMM model adopts the critical success factor approach of assessing the implementation process capability of an organisation, while the CMM provides as a base on which to develop a maturity model. A Rural ICT Project Sustainability Maturity Model (RICTS-MM) can display the evolutionary path of the ability of a rural ICT project to incorporate appropriate project practice that promotes rural ICT project sustainability. The development and validation of such a maturity model would be of great benefit to those development organisations wishing to improve their overall project sustainability.

8.3.4 An Exploration of the Integration of Key Sub-projects in the Implementation of Rural ICT Projects

A rural ICT project may consist of sub-projects that are key to achieving the overall goal of the project. These sub-projects are sensitive to the critical success factors of sustainability, and support the overall project throughout its progressive development. It is important to investigate how to integrate these sub-projects, such that they are effective and efficient in achieving the overall project objective. Appropriate sub-projects that are aligned to the specific project objectives need to be selected for a rural ICT project.

8.4 In Closing

ICTs are highlighted as fundamental supportive tools for rural development processes, particularly in the context of the rapidly growing information and knowledge society. In order for ICTs to be effective in rural development, it is essential that they are implemented appropriately in rural communities, such that they are sustainable and have a sustainable impact on various development activities. The RICT-PLC model provides a guideline for rural ICT project management. The application of this guideline in existing and proposed ICT projects contributes to promoting sustainable ICT projects for rural development.

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Appendix A

Millennium Development Goals (UNDP, 2003)

GOALS	TARGETS
Goal 1: Eradicate extreme poverty and hunger	1. Halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day 2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger
Goal 2: Achieve universal primary education	3. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
Goal 3: Promote gender equality and empower women	4. Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015
Goal 4: Reduce child mortality	5. Reduce by two thirds, between 1990 and 2015, the under-five mortality rate
Goal 5: Improve maternal health	6. Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio
Goal 6: Combat HIV/AIDS, malaria and other diseases	7. Have halted by 2015 and begun to reverse the spread of HIV/AIDS 8. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases
Goal 7: Ensure environmental sustainability	9. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources 10. Halve by 2015 the proportion of people without sustainable access to safe drinking water and sanitation 11. By 2020 to have achieved a significant improvement in the lives of at least 100 million slum dwellers
Goal 8: Develop a global partnership for development	12. Develop further an open, rule-based, predictable, non-discriminatory trading and financial system. Includes a commitment to good governance, development, and poverty reduction – both nationally and internationally 13. Address the special needs of the least developed countries. Includes: tariff and quota-free access for least-developed countries' exports; enhanced programme of debt relief for HIPCs and cancellation of official bilateral debt; and more generous ODA for countries committed to poverty reduction 14. Address the special needs of landlocked countries and small island developing States 15. Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term 16. In cooperation with developing countries, develop and implement strategies for decent and productive work for youth 17. In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries 18. In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

APPENDIX B

Business Plan Considerations

- **The project purpose and mission statement** – Brief introduction to the project idea, the need / opportunity and how the project addresses the opportunity.
- **Sponsorship & ownership** - A clear outline of the ownership structure and participants in the project, and whether the project will be a franchised or independent business, a community co-operative, an arm of local government, etc. Preferably it should be, from the outset, a commercial entity, even if parts are known to need contribution or subsidisation.
- **Market and beneficiary assessment** - A demand assessment (based on demographics, interests, economics, needs and affordability). The assessment should include a market description or study that assesses the role of the project compared to the availability of other similar services. The presence of other suppliers in the location (e.g. for a public access project, identify other PCOs/ phone shops/ telecentres, schools, hospitals), and the specific needs of the region, including the kind of information or services needed by the local community. Explain how they will benefit and how/why they will justify paying for the services. This should include an estimate of the expected number of calls, network 'accesses', minutes of use, messages, pages printed, photocopies, forms delivered, or whatever mode of information and service is to be offered.
- **Legal and regulatory framework, licences and authorisations** – Summary of the status of the project proposal with respect to licenses and authorisations. Does the project, or the site owner(s) require a license or special authorisation to proceed and have these been granted. If special authorisation is required, describe the steps taken and the likely outcome, the conditions attached and/or the outstanding issues to be resolved.
- **Marketing and sales plan** – Explanation of how the market potential will be realised, people sensitised and made aware of the service(s) and, if appropriate, drawn to the site(s).
- **Competition** – An assessment of how the market and sales assumptions could be affected by other similar installations, networks or alternatives, and the impacts on the project target.
- **Technical assessment** - An assessment of the area's access to telecom infrastructure, the topography, the access technology and other systems (e.g. power) required. This assessment should suggest the technology that best fits the characteristics of the site(s), and the initial and ongoing costs to connect and maintain the facility or facilities.
- **Financial worksheet** - This should contain start-up expenses and start-up costs, as well as projections of number of users, traffic usage, prices and revenues, expenses, financing costs, operational costs and salaries, etc. Financial schedules, showing breakdown of costs and revenues for each major item, unit, department or service (e.g., telephone, fax, computer & email, training, photocopying, etc.) should be included. *Amortisation of costs, depreciation and replacement* strategy should be shown.
- **Financial 'bottom line' analysis** - This must show the profitability calculation and /or any variations from profitability explained, justified and projected into the future to show how the situation will improve.
- **Funding requirements** - Summary of funding requirements and of financial contributions, including in-kind contributions, from all sources. The scale of the investment and the scope of services proposed must be justified.
- **Operational plan** - Organisational chart, staffing plan, equipment and facility plans and assessment of possible problems and solutions.
- **Training, capacity building and any other human resource development** – The needs of the project and the assigned effort, plan, costs and partnership(s) to meet all stated goals for staff or users.
- **Community inputs** - If appropriate, an assessment of support from the local community (to confirm that the requirements are understood by the community and the sponsor(s).

- **Partnership(s)** – After assessing all of the market, technical, operational, financial and human resource development needs and challenges, outline clearly the nature of partnerships required and secured for successful project implementation. Examples could include a selection of the following: commercial franchiser (e.g. a business with local operating experience); local merchants; telecom operator; Internet service provider; NGO and community organisation specialising in training; University; etc.
- **Risk and sensitivity analysis** – how is the project's performance and success affected by various market, sales, cost, pricing or operational scenarios, especially the worst cases.

(Dymond and Oestman, 2004: 51)

APPENDIX C

Project Management Process Groups and Knowledge Area Mapping

KNOWLEDGE AREA	PROJECT MANAGEMENT PROCESS GROUPS				
	Initiating	**Planning**	**Executing**	**Monitoring and Controlling**	**Closing**
Project Integration Management	Develop project charter, Develop preliminary project scope statement	Develop project management plan	Direct and manage project execution	Monitor and control project work, Integrated change control	Close project
Project Scope Management		Scope planning, Scope definition, Create WBS		Scope verification, Scope control	
Project Time Management		Activity definition, Activity sequencing, Activity resource estimating, Activity duration estimating, Schedule development		Schedule control	
Project Cost Management		Cost estimating, Cost budgeting		Cost control	
Project Quality Management		Quality planning	Perform quality assurance	Perform quality control	
Project Human Resource Management		Human resource planning	Acquire project team, Develop project team	Manage project team	
Project Communications Management		Communications planning	Information distribution	Performance reporting, Manage stakeholders	
Project Risk Management		Risk management planning, Risk identification, Qualitative risk analysis, Risk response planning		Risk monitoring and control	
Project Procurement Management		Plan purchases and acquisitions, plan contracting	Request seller responses, Select sellers	Contract administration	Contract closure

Table C1: Project Management Process Groups and Knowledge Area Mapping (PMI (2004) in Schwalbe, 2006: 77)

APPENDIX D

The Interview Schedule

QUESTIONS FOR THE PROJECT TEAM

1. Give me a brief overview of your project.
2. What are the main goals and objectives of the project? Is there documentation that explains and describes these goals and objectives?
3. ICT Use
    a. What ICT applications are in use? Why did you choose these specific ICT applications?
    b. What are the current specific uses of ICT in your project?
    c. Do they support a specific rural development activity currently taking place in the rural community?

> **Prompts: LITERATURE USES OF ICT**
> 2.6.1 Entrepreneurial Activity and Market Access
> 2.6.2 Access to Education and Knowledge
> 2.6.3 Addressing Health Challenges
> 2.6.4 Rural Empowerment and Participation
> 2.6.5 Addressing Environmental Sustainability
> 2.6.6 Establishing Community Networks

    d. Are there any further uses for ICT that you have planned for the future?

4. Challenges and Barriers to ICT Use
    a. What are the barriers and challenges to ICT use that you think the *community* has faced?
    b. What have you done to mitigate and deal with these challenges?

> **Prompts: LITERATURE CHALLENGES TO ICT USE**
> 2.7.1 Infrastructure Access
> 2.7.2 Illiteracy, Content and Education
> 2.7.3 Insufficient Training and Capacity Building
> 2.7.4 Financial Constraints
> 2.7.5 Political Constraints
> 2.7.6 Social and Cultural Challenges

c. What are the barriers and challenges to ICT implementation in the community that you think the *project team* has faced? (From managing the project to trying to implement the project)

5. The Project Life Cycle Approach

a. Does your project aim to promote rural ICT project sustainability?
b. Does the community significantly drive the project?
c. Is there a specific project management approach (e.g. PMI or PRINCE2) you have adopted for the implementation of your ICT projects?
d. Have you adopted an approach in any process of your project, from other ICT projects e.g. Shuttleworth?
e. Does the project have any phases (even if it is flexible)? What phases (or proposed) does your project go through, with the focus of promoting the sustainability of the project?

Phases of the Project (Prompts for question e.)

i. Concept

- Describe how the initial proposal or idea of the project came to be. For example, including Robin Palmer's involvement and communicating with the Trust/Leaders in the community, through also collaborating with Fort Hare.
- Was there any feasibility study to determine the community as an appropriate place to implement the ICT project?

ii. Development: Now for more detailed planning

- Did you define what phases your project would go through to accomplish the goal of the project
- What:
  - Activities and tasks did you plan for the project? Why these tasks and activities?
  - How (or what) did you plan for resources and finances to be allocated to the project? Or what did you plan for in terms of the allocation of resources and finances?

iii. Implementation

- What planned tasks and activities have you implemented?
- Is the project significantly susceptible to rural constraints and activities? e.g. in terms of the challenges they face like language barriers, literacy, technophobia *etc.*
- Is the project continuously monitored and controlled? Why? How?

iv. Close-out

- What activities and tasks are practiced (or are planned to be practiced) when the project comes to an end? (Such as handing over project to community to fully manage, and establishing the extent of maintenance by the project team)

f. How would you like your existing project life cycle or phases in your project to improve, in terms of what practices/techniques to practice in each phase?
REMEMBER: Differentiate between what was actually done and what they realised was wrong and would do differently next time

6. Are there any major plans for the future of the project? What are they?

QUESTIONS FOR THE COMMUNITY

1. ICT Use
    a. What are the current specific uses of the computers in the community? What applications do you use?
    b. Do they support a specific rural activity currently taking place in the community?

> **Prompts: LITERATURE USES OF ICT**
> 2.6.1 Entrepreneurial Activity and Market Access
> 2.6.2 Access to Education and Knowledge
> 2.6.3 Addressing Health Challenges
> 2.6.4 Rural Empowerment and Participation
> 2.6.5 Addressing Environmental Sustainability
> 2.6.6 Establishing Community Networks

    c. Are there any future uses for computers to support development in Dwesa that you can take advantage of with the project?

2. Challenges and Barriers to ICT Use
    a. What are the barriers and challenges to computer use that you have faced?
    b. What have you done to ease and deal with these challenges?

> **Prompts: LITERATURE CHALLENGES TO ICT USE**
> 2.7.1 Infrastructure Access
> 2.7.2 Illiteracy, Content and Education
> 2.7.3 Insufficient Training and Capacity Building
> 2.7.4 Financial Constraints
> 2.7.5 Political Constraints
> 2.7.6 Social and Cultural Challenges

3. Suggestions for improvement from the community. Are there any suggestions for improving the way the project was introduced, managed, and implemented in the community?
4. How do you think the community could keep this project on-going (sustainable)?

APPENDIX E

Case Study Descriptions

1. The Dwesa ICT Project Case Study

1.1 The Rural Context

Dwesa is a rural area situated within the former Transkei region, along the wild coast of the Eastern Cape Province of South Africa. It forms part of the Dwesa-Cwebe area which comprises the protected area (nature reserve) and frontline communities extended over a land area of approximately 15 254 hectares (Palmer, Timmermans and Fay, 2002: 2). The Dwesa-Cwebe area is divided into two administrative areas, which encompass the northern side of the Mbashe river – Hobeni and Cwebe that together form Cwebe, and the larger of the two area to the south of the river – Mendu and Msendu which together form Dwesa. These two areas administered jointly form the Dwesa and Cwebe nature reserve. The location of Dwesa-Cwebe is shown in the map in Figure E1.

Figure E1: Location of Dwesa-Cwebe on the Eastern Cape Wild Coast (Palmer, Timmermans and Fay, 2002: 3)

The Dwesa-Cwebe areas have both become a development initiative as the natural environment consisting of the nature reserve and wild coast that they share in the chief asset for the communities (Palmer *et al.*, 2002: 279). This chief asset serves to provide income generating activities to support rural development in the area. The unspoiled natural scenic beauty and wild beaches significantly promote ecotourism in the region, as shown in the map in Figure E2. The area is quite popular for tourism, especially at the Dwesa reserve where at times during the year, all tourist cabins are fully

booked advance. Furthermore, the high levels of rainfall and rich soil in a very dry country area, has potential for controlled agricultural intensification and commercial forestry. Nevertheless, the target for development vision for Dwesa-Cwebe has been taking advantage of their rich natural asset.

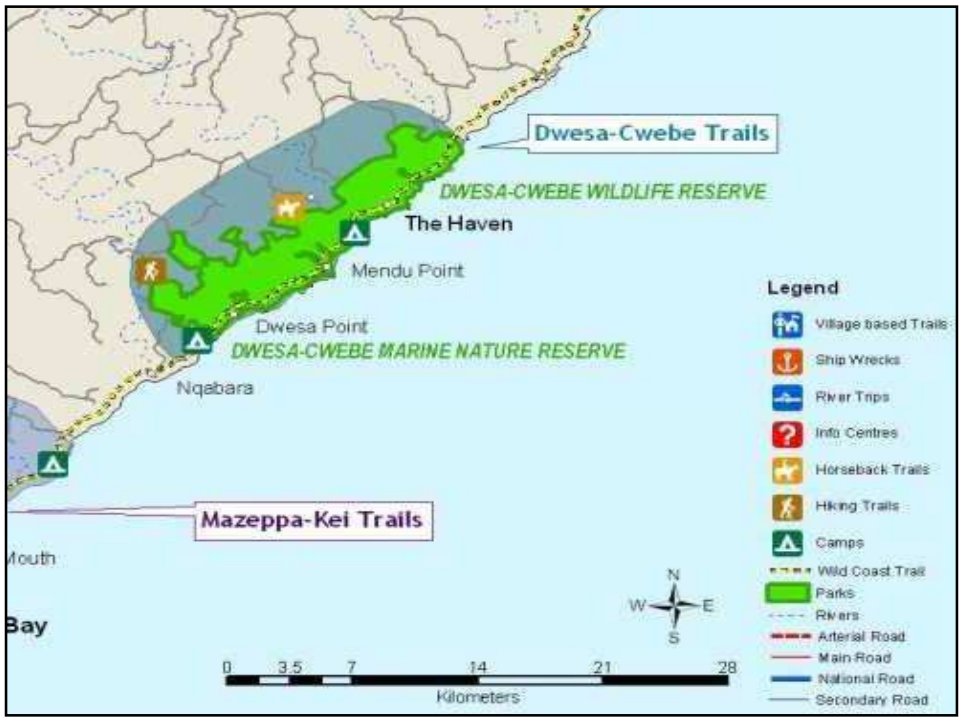

Figure E2: The Dwesa-Cwebe Map depicting Tourism and its Potential (Thinyane, 2006)

The ownership of the reserve has recently been restored to the community (Palmer *et al.*, 2002: 275). The community is represented by the Community Property Association's (CPA) and the Dwesa-Cwebe Land Trust. They have managed to secure a restoration package of R14 million, and a Settlement and Land Acquisition Grant of R16000 per Household. Additional funds toward developing tourism in Dwesa have been contributed by the European Union and also generated through leasing fees from the provincial nature conservation agency, the Haven Hotel, and privately owned cottages. The communities have pooled their grants which add up to R9 million, and have invested in the development of local tourism infrastructure. Approximately 15000 people are dispersed throughout the nature reserve and therefore local and national communication could play a significant role in linking communities, so as to promote social capital and combined action in rural development.

Currently, tourism development in Dwesa is hampered by a scarcity of knowledge and experience of tourism in the community. In this sense, the community has limited involvement in tourism. Rather, the development activity focuses more on the natural capital of the area (the nature reserve) managed by a few people in the community, even though much potential exists in cultural and heritage tourism (Palmer *et al.*, 2002: 273). There are different types of capital in the community that could be exploited, but community members tend to 'put all their eggs in one basket' as they become involved in a rural development scheme that focuses on a single agent, ecotourism. Therefore, other types of capital should be explored for rural development, that can still take advantage of tourism, through for instance, human capital (the culture, local knowledge, and particular livelihoods), physical capital (rural infrastructure and technology), and social capital (capacity for mobilising local relationships) (Palmer *et al.*, 2002: 288). These can all be applied in natural tourism through the enhancement of authentic cultural and heritage tourism, given Dwesa-Cwebe rich Xhosa tradition and historical background (from apartheid times).

Dwesa-Cwebe is faced with socio-economic challenges associated with poverty and poor development. An O'Leary macro-survey by Palmer *et al*. (2002: 29) indicates that there is widespread poverty and a considerable variation of income among households in the Dwesa-Cwebe area. Palmer *et al.* (2002: 29) characterises the Dwesa-Cwebe challenges associated with poverty as follows:

> *"A key theme in the regional and local history of this remote area is the dearth of infrastructure and inadequate services at Dwesa-Cwebe – vital factors in the cycle of underdevelopment. This is the downside of a relatively 'unspoiled' environment. The severe local limitations of the regional road network, the telecommunications that are now being re-installed following decades of disrepair, the lack of national grid electricity and reticulated, safe water, adequate health care and educational facilities have contributed significantly to underdevelopment in the past and continue to do so."*

However, some development has taken place since the book by Palmer, Timmermans and Fay (2002) was published. For example, the recent water project in Dwesa-Cwebe has improved the access to free fresh water in the area. Building on communication and rural development can subsequently be supported by ICTs, which can enable the effective operation of existing development activities.

1.2 Introduction to the Dwesa ICT Project

The telecommunications company of South Africa, Telkom, has established a network of research centres around the country, specifically situated in academic institutions. These research centres form Telkom Centres of Excellence (COE) that are sponsored by Telkom and its industry partners. The COEs at Rhodes University and the University of Fort Hare have collaborated together in the development of an ICT project in the rural region of Dwesa.

The project team is currently involved in the development of an open source/standard e-commerce/telecommunication platform to deploy within rural and semi-rural areas in South Africa. The ICT project aims to promote e-commerce in tourism and other rural development activities, through, for example, providing services such as booking online, acquiring historical information from the community, and promoting market collaboration between rural craftsman and local and international markets. The project that commenced in November 2005, is in its early stages of development, and provides an opportunity to observe the project management techniques applied to promote sustainability. The researcher was exposed directly to the operations, practices, and challenges associated with the project through participatory-observation from early development to intermediate operation. This project is also significantly a collaboration of tertiary level research, with all students experiencing a real-life ICT project for the first time, and hence reveals the limitations of certain project practices and areas for improvement in the management and implementation of the project. Nevertheless, there are successful aspects of the project given some techniques they have adapted, and this has equipped and provided students with the experience and reality of rural ICT projects.

The rural communities that exist in Dwesa include Mpume, Ntubeni, Ntlangano, Ngoma, and Mendwane. The Dwesa ICT project team chose to implement the project within the Mpume community, at Mpume Primary-Junior Secondary School. The school is conveniently located on the main road in Dwesa, and acts as a point of access for community meetings and activities. The project aims to target not only teachers and students, but also community members at large. The school also holds a good standing in the community, and the headmaster and teachers are enthusiastic in supporting the project, hence they play a significant role in driving the project in the community. Furthermore, the infrastructure at Mpume School for the initial implementation of ICT

applications was appropriate; especially given the fact they had an appropriate building space, and electricity.

1.3 The Project Stakeholders

The stakeholders of the Dwesa ICT project are:

Rhodes University

- Prof Alfredo Terzoli *(Project Leader and Academic Supervisor)*
- Bradley Whittington
- Hannah Slay *(Post Doctorate assistant of the COE)*
- Lorenzo Dalvit
- Mamello Thinyane
- Robert Alfonsi

The University of Fort Hare

- Prof Hyppolite Muyingi *(Project Leader and Academic Supervisor)*
- Gary Ndlovu
- Martin Mandioma
- Naomi Isabirye
- Paul Tarwireyi
- Sicelo Njenje
- Thandeka Mapi

The Teachers at Mpume School in Dwesa

- Mr Pakati *(Headmaster)*
- Mr Jabe *(Deputy Headmaster and Project Champion)*
- Mrs Gxarisa *(Project Champion)*
- Mr Xatasi
- Ms Mangwane
- Ms Mpahlwa
- Mrs Sotyhatya
- Mrs Mgoqi
- Mr Yose
- Mrs Ndomfanya

Community Members (Assist in Training)

- Neziswa Mcingi *(Pinki)(Youth Project Champion)*
- Andisiwe Mcinga
- Noluvo Mgedezi

1.4 Project Objectives

The main objective of the Dwesa rural ICT project centres on the development of an ecommerce platform. The main objectives of the project are as follows:

c) The primary objective of this project is to develop and field-test the prototype of a simple, cost-effective and robust, integrated e-commerce/telecommunication platform to deploy in marginalized and semi-marginalized communities in South Africa where the majority of the South African population live. These communities, by sheer size and because of current political dynamics, represent a strategic emergent market. The integrated e-business/telecommunication platform, built on hardware components that are easily available (and so inexpensive without sacrificing quality), will use open source software and open standards in all its software components. This decision guarantees cost-effectiveness and robustness from the start. Simplicity will be facilitated by a 'no-frills' approach to the design (still based on user-requirement elicitation) as well as using special care in building the essential user interfaces. The platform will be designed in such a way as to cater simultaneously for more than a single small and micro enterprise, in order to reduce acquisition and running costs to an acceptable level.

d) The second objective of this project is to build technically skilled human resources in the field of e-commerce, particularly, but by no means only, in the context of supporting e-commerce activities in marginalized and semi-marginalized communities. These technical skills will span both core and ancillary technologies, focussing on the development of web-based front-ends, back-end databases with appropriate storage support, deployment of appropriate network infrastructure (both fixed and mobile) and terminals. Skills will also be developed through the exposure of tertiary level students to the processes of applied research as well as via dedicated academic training in the appropriate areas. It is not necessarily a primary objective, but forms the basis for the first objective to be achieved.

In order for the above objectives to be achieved, sub-projects exist to support the main project objectives. According to the Rhodes University (RU) project leader, Alfredo Terzoli, the e-commerce platform prototype will be constructed through the pursuit, and integration, of smaller, focussed sub-objectives, through which a range of artefacts and solutions will be developed, as well as new knowledge that adapts and localizes, in innovative and appropriate ways, the general e-commerce body of knowledge and technology to the reality of marginalized and semi-marginalized communities. The title of research sub-projects by each student is as follows:

A) *Eliciting user requirements for an e-commerce platform for entrepreneurs operating in Dwesa* (Naomi Isabirye): The project aims to establish a set of requirements elicitation tools and techniques that effectively allow analysts to determine the real user requirements of E-Commerce for rural entrepreneurs.

B) *The adoption of ICTs in rural areas (a study of Dwesa community in Transkei)* (Thandeka Mapi): The project aims to investigate the diverse ways in which people adopt ICTs in rural areas, and the problems encountered when using ICTs that might lead to discontinuance and slow adoption.

C) *Backhaul connectivity options for Dwesa* (Martin Mandioma): The project aims to explore access technologies that can be used to provide connectivity in Dwesa. This includes wired and wireless access technologies available for connectivity in South Africa.

D) *Low cost, IP-based access loop for consumer telephony in rural communities* (Bradley Whittington): This project focuses on using Open Source Software to empower people, by researching and deploying an Asterisk server to a rural area, providing telephony to people in infrastructure bare areas, using IEEE 802.11 and WiMAX wireless networks, and SIP hard phones.

E) *Software Engineering of a robust, cost-effective e-Commerce Platform for Disadvantaged Communities* (Sicelo Njenje): The project aims to design and implement a shopping mall software framework for marginalized communities that help in the empowerment of the local community entrepreneurs. The system aims to be simple, extensible, flexible, and has a low cost of management.

F) *Developing an Internet Cost management System for marginalized communities* (Paul Tarwireyi): The project aims to develop a cost management system for the e-commerce platform, that is simple and flexible for rural communities to use.

G) *Development of a music component for e-commerce using indigenous knowledge system* (Gary Ndlovu): The project aims to develop an e-commerce component for South African indigenous music, which can be localized to suit language and everyday understanding in rural communities.

H) *Implementation of Knowledge (Learning) Networks through ICTs in Marginalised Communities* (Mamello Thinyane): This project entails the implementation of semantically rich, local knowledge repositories that are utilised in a heterogeneous context as far as content and access methods are concerned (i.e. multi-modal access to multimedia content). This is with the long-term view of establishing a knowledge society in rural, marginalized communities and activating these societies to engage in the knowledge economy.

I) *Language problems in ICT Education* (Lorenzo Dalvit): This project investigates the language problems encountered by Dwesa community members during ICT training and use.

J) *E-literacy course for teachers using free open source and b-learning* (Robert Alfonsi): This project focuses on teaching ICT literacy and integration skills to teachers in disadvantaged schools through the aid of conceptual and mind maps. This aims to make the study of computer literacy more accessible to teachers who, in most cases, encounter computers for the first time.

1.5 ICT Applications Used

The ICT applications mentioned below are the technologies that have been implemented. There are other technologies that will be adopted in the future development of the platform; however, currently the technology implemented includes:

1.5.1 Hardware:

- **A VSAT** (Very Small Aperture Terminal) which is an earthbound station used in satellite communications of data, voice and video signals, excluding broadcast television (Pagarkar, 2004: 1). A VSAT consist of two parts, a transceiver that is placed outdoors in direct line of sight to the satellite and a device that is placed indoors to interface the transceiver with the end user's communications device, such as a PC. The VSAT was installed by Telkom in May 2006 at Mpume, with the indoor device placed in Mr Pakati's (Headmaster's) office. The cables were long enough to reach the chosen class room for a future telecentre. This device will host the Dwesa e-commerce platform.
- **A WiMAX (Worldwide Interoperability for Microwave Access) Terminal**. This forms part of Project C and D, on appropriate communication technologies for rural areas as it will eventually host a potential fixed telephony service among different communities in Dwesa. This requires a computer that can act as a router to another computer at a different location. All the routing applications form a core part of Linux, therefore there was no need for a third party software to acquire, install or configure for setup; the operating system is simply installed with all the necessary resources out of one box. Therefore less time is spent sourcing software, it does not cost the team, and a very stable robust system exists. The licensing of WiMAX is associated with frequencies; therefore a licence from the Independent Communications Authority of South Africa (ICASA: The South African regulator of frequency and spectrum) is required to transmit data over a frequency. Nevertheless, the project falls under Telkom; therefore the licence is covered under their umbrella.

- **10 Personal Computers:** The computers are setup as a thin client whereby all the computers run off one server (where the necessary resources needed by each individual computer are hosted). The benefit of this in the future is that refurbished/corporate roll down computers can be used, and existing computers can be replaced easily, without having to struggle with set up. It would just be a matter of plugging in the computers and linking them to the server.
- **Storage devices - Flash Disks:** These were distributed to teachers and community trainers to save personal files, and promote public access to computers as teachers are ensured of privacy.

1.5.2 Software:

- **The Edubuntu Operating System:** This is an open source Linux-based operating system. The project aims to host the ecommerce platform on open source software and standards. Edubuntu was specifically chosen because it is appropriately designed for an educational environment with useful tools for teaching rural people basic computer literacy. Examples of its applications include a full open office Suite (Writer and Calc), educational games (for mouse skills and typing), Jabber (for chatting online). It is also easier to install with only one CD, it has good relevant software, and it does cost anything for the team to install. In addition, the Edubuntu operating system is also available in local languages such as Zulu and Xhosa which to an extent alleviates the barrier of language.
- **The Gutenberg Project:** This is a collection of free online books. Originally, an offline version of the Gutenberg project was installed onto the computers, but later when the VSAT was installed, the online version became accessible.
- **Wikipedia:** a free content encyclopaedia of information on many different subject areas collaboratively written by people around the world. This provides community members with a vast amount of information that could support development activities. Originally an offline version was installed on the computers in Dwesa, but when the VSAT was installed at Mpume, the online version became accessible. An online Xhosa version of Wikipedia will be introduced to the community by the project team. One of the project team members who are doing research on knowledge networks, indicated that if they see the need for it, they would put a Xhosa/English Wikipedia server that is specific to the Dwesa community for collecting/developing local content and knowledge.

1.6 Phases of the Dwesa ICT Project

1.6.1 Project Idea Generation and Concept (January – October 2005)

This phase of the project is associated with generating a proposal for the project, which defines the needs and concepts that underlie the project. The idea of the research project generated from the need to especially develop a postgraduate programme in computer science at the University of Fort Hare. The Telkom Centre of Excellence (COE) at the University of Fort Hare was established in 2002 within the Computer Science Department. The focus of this COE is to explore the way in which e-commerce (and supporting technologies) can be used to foster and support economic development in marginalised communities of South Africa (Muyingi: 2004). The COE at Fort Hare has collaborated with the Telkom COE at Rhodes University to launch research projects that aim to support research into the use of ICTs for development. The COE at Rhodes University was established in 1997 and collaboration with Fort Hare University began in 2002. Its research focus is on developing network architectures and services that are oriented toward local needs and conditions, characterized by high heterogeneity.

The Project leaders of the COEs at Rhodes and Fort Hare University, Alfredo Terzoli and Hyppolite Muyingi, collaborated together to propose a project, and apply for funding to support it. The idea of the Dwesa ICT project began in 2004, as the leaders had to institute a project that was innovative and unique (ICTs in rural areas), and that could fit the profile of current research postgraduate students. This project would contribute toward building a research culture that is sensitive to the challenges associated with rural development in South Africa. Subsequently, the idea for an open source/standard e-commerce/telecommunication platform was developed which would cater for the research focus associated with the two COEs.

The rural area of Dwesa was chosen as an appropriate location for the project, because of the ties it had previously formed with the Rhodes University Anthropology Department. A researcher that department, Robin Palmer, and his research team had played a significant role in assisting the community to regain the rights to their land. His many years of experience in the Dwesa community provided the background knowledge for the ICT project team. The background knowledge of Dwesa reveals factors that the project team should be aware of, in order to promote the sustainability and success of the project. These factors are associated with social, cultural, geographical,

economic, and political influences. The Dwesa area provides an ideal environment representing marginalised communities to field test the e-commerce platform prototype.

Once the project concept was finalised, the project team decided to present the ICT project idea to the Dwesa Development Board in June 2005. The Dwesa Development Board that manages the Trust (Political body) was initially approached to create awareness of the ICT project, in an attempt to achieve project buy-in from them, as they tend to influence the participation of the community in development activities. It was a challenge to get an immediate response and agreement from the Board, but after continuous discussions between the Board members and project leaders, the project team was eventually given the go-ahead to start the project in the community. The project team then planned for the first trip to further explore the community for ICT project potential.

1.6.2 Project Feasibility (November)

The project feasibility stage focused on determining an appropriate location for the ICT project within the Dwesa community. In June 2005, the two project leaders and two research students travelled to Dwesa to present the project to the board. After a limited exploration of the community, the project team determined that the nature reserve offices would be an appropriate place to set-up the project, as its infrastructure was suitable. However, for political reasons, the reserve manager refused the proposal. As a result, the team decided to propose the project to Mr Mbola, the owner of a local shop (with electricity and safety to house ICT equipment) located close to the nature reserve. Mr Mbola happened to be a committee member of the board, and was initially supportive of the project.

The project team, consisting of six research students planned for the next field trip in November 2005 (for one week). The field trip was intended to coincide with the Telkom installation of the VSAT satellite that would provide Internet connectivity in the area (Thinyane, 2005: 1). The aim of the field trip was to also explore the community to get a feel for existing social, cultural and economic activities. In addition, the project team would be introduced especially to the community members that worked at Mr Mbola's shop. At this stage of the project, the VSAT, which had been applied for in October 2005, was supposed to have been installed by the time the project team arrived in Dwesa. Unfortunately, this did not take place, and this gave a negative impression to Mr Mbola who had expectations of the project. Furthermore, it appeared while conversing with Mr Mbola, that he did not understand the purpose of the project and its potential in the community. Mr

Mbola was unfamiliar with these aspects of the project, and therefore became reluctant to allow the ICT project to be located at his shop. It was important for the project team to explain the purpose of the ICT project in the community, and how the shop would be used to house the technology and become accessible to the community for future use.

The project team decided to explore other possible locations for the ICT project as it appeared the VSAT would not be installed on this particular field trip (November), and Mr Mbola was reluctant about the project. The local Msendo clinic and six schools (Ntubeni Junior Secondary, Mpume Junior Secondary, Mampondweni Senior Primary, Ngoma Junior Primary, Lurwayiso Junior and Senior Secondary, and Mendwana Junior Secondary) were surveyed as possible bases for the ICT project. The six schools were particularly explored and profiled for future telecommunication network points in relation to project C and D's research. In addition, schools form a crucial entity in the roll-out of an ICT solution in Dwesa, in terms of providing the infrastructure required and potentially being involved in facilitating skills development and computer literacy initiatives (Thinyane, 2005: 1). A detailed profile of the schools and clinic is provided in Appendix F. Ultimately, Mpume Primary and Junior Secondary School (shown in Figure E3) was chosen as a base for the Dwesa ICT project. Mpume School was chosen for the following reasons:

- It is conveniently located on the main road in Dwesa, and acts as a point of access for community meetings and activities – a good Line of Sight (LOS)
- The project aims to not only target teachers and students, but also community members at large. The school holds a good standing in the community, and the headmaster and teachers are enthusiastic in supporting the project, hence they play a significant role in driving the project in the community
- The Headmaster, Mr Pakati, has offered one of the classrooms as a centre to house the computers and train community members
- The infrastructure for the initial implementation of ICT applications is appropriate

Mpume School appeared to be an appropriate location for the ICT project, as it could potentially reach out to the community more effectively than Mr Mbola's shop. Therefore, the team also made changes to the VSAT application so that it would now be installed by Telkom at Mpume School.

Figure E3: Mpume Primary and Junior Secondary School

1.6.3 Technology Introduction and Training (January – March 2006)

Once Mpume School had been chosen as an appropriate location for the Dwesa ICT project, the next phase focused on introducing the technology to the community, and training for its use. The computers were set up at Mpume School, and the training was centred on teachers, who would eventually play a role in training community members when the project team was away (train-to-train methodology). At this stage, the VSAT had still not been installed; therefore training would focus on basic computer literacy.

A. Initial Training: Technology Introduction

The field trip in January was associated with introducing the technology to the community. The aim of the initial trip was to set up four computers, and provide an introductory computer literacy course to the teachers at Mpume School. The focus was to give the teachers a feel and understanding of what computers are, and their potential in enhancing the education process, therefore improving the teachers' confidence in using the computers, and not really their competence.

Project Meeting and Development with the Community School

The project team met firstly with the Headmaster, Mr Pakati, the Deputy Headmaster, Mr Jabe and a few other teachers to discuss the intention of the trip, and decide on an appropriate time to train the teachers. It was established that all ten of the teachers were enthusiastic about training, and were willing to re-schedule their school classes. In order to not disrupt lessons at the school, the project team decided to divide the teachers for training into two groups at different times. An extra session after 3pm was offered to teachers who had any questions regarding the course module they had completed on a particular day.

The staff room was chosen to set up the computers for training the teachers. Security was quite an issue of discussion, as the staff room had been broken into before, therefore it was decided that the computers would be stored in Mr Pakati's office after school hours, which seemed more secure (burglar bars, and two doors securing the office). The teachers also suggested that it is important to inform the community about the project, so that they understand that it is there to benefit the community. In this case, the community would take measures to ensure that the computers are secure. Mr Pakati was therefore advised to inform the Chief of the community, who would notify the community about the project.

The project team decided to give local responsibility of the project to the teachers at the school, and also promote local ownership of the project. As a result, two key project champions were elected to champion and drive the project in the community. Through observation and interaction, the project team were able to identify the project champions at Mpume School, who would play a significant role in driving the project. Mr Pakati, as Headmaster of Mpume, is a critical stakeholder for the project and to an extent may be a project champion. However, the main project champions chosen were:

- Mr Jabe, the deputy Headmaster, who is very enthusiastic about the project, and attempts to introduce ideas of how to get other schools and the community involved.
- Mrs Gxarisa, a Grade 1 teacher, who picked up the use of computers quickly, and is very interested in how she could apply it to teaching. An important aspect is also her gender, as gender discrimination has played a significant role as a social cultural barrier, in rural communities especially. Women play complex and vital roles in economic and social development, with their wisdom and indigenous knowledge that is rooted in culture, traditions, value, and experience, especially in Dwesa (IDRC, 2003: 68; McNamara, 2003: 75).

These two particular champions were chosen because of their significant involvement and enthusiasm for the ICT project to be successful and sustainable in the community. In addition, they are well known and respected members of the community, and therefore are more effective in promoting the ICT project. More project champions, or target group leaders would be chosen at a later stage of the project to represent the community, youth, and students.

At the end of the field trip, the project team met with the project champions, Headmaster and teachers to discuss the tasks that needed to be accomplished before the next field visit to Dwesa. This would keep the community accountable to the success of the project. The tasks included:

1. Training the teachers at Ntubeni School in basic computing skills. Ntubeni was a school the project team had initially visited (but did not have sufficient infrastructure)
2. Training a few students at Mpume
3. Preparing the classroom designated as a community computer centre
4. Devising appropriate ways and structures to facilitate the training of wider community members

Introductory training

The community was primarily trained on basic computer literacy. The Dwesa project team did not design any particular structure for training the teachers, and only one project team member organised training material for the introductory training sessions. The approach to training was that an individual person would brief the teachers on the theory, and then each project team member would train an individual or pair of teachers on practical work. The project trainers were not necessarily given a guide on how to train the teachers, but were instead advised to go through the training material in the way they thought was appropriate. This was obviously a challenge for the trainers, as they were, for the first time, training teachers who had never seen a computer before. The training approach was also adaptive and reactive to the teachers' requirements that progressively came up as they used the computers. Aspects of the training sessions:

- Initially, the project team intended to simply provide teachers with basic computer theory/knowledge (hardware and software), and train them how to use Open Office Writer. However, teachers later showed an interest in using Open Office Calc for storing student records, and therefore the project team decided to train teachers how to use Calc.
- In order to promote an understanding of computer theory, the teachers were provided with a demonstration of hardware. For example, the use of a scanner and printer were demonstrated. In addition, the teachers were given the opportunity to observe what a CPU (Central Processing Unit) box looks like inside, which made them feel more comfortable with the technology, as they began to have an idea of what they are working with. This reduces the effects of "Technophobia" which is a significant socio-cultural barrier in discouraging the use of ICTs in rural areas of some developing countries. The scanner and

printer were not donated to the school, as the project team had decided they would encourage the community to raise funds to purchase their own printer so that they do not become too dependent on donations (promotes local ownership).

- The teachers were also trained how to set-up/connect the computers, as they would be responsible for this while the project team was away
- Training was supported by game applications on Edubuntu that assisted in improving the mouse and keyboard skills of trainees.
- The project team also decided that they should install an offline version of Wikipedia and the Gutenberg Project to provide teachers with access to a wide range of educational information to enhance the learning process. This decision was not on the planned agenda of the trip, therefore, some members of the project team that were arriving during a later stage of the week long field visit, would bring the necessary software.
- Teachers were also trained on how to use flash disks to store their personal files.

Community Awareness

At this stage of the project, the project team decided to give the responsibility of community awareness to the project champions and teachers. Mr Jabe invited the team to a local sports day to advertise the project among other school teachers and government officials. The project team was able to discuss the potential of project with a few local teachers. The sports day was held near Nqabara Secondary School, in the Nqabara community.

B. Training: Technology Competence

The second part of this phase (March 2006) of the project was mainly associated with training teachers to become competent in using Edubuntu applications, especially Open Office. In addition, a Geographical Positioning System (GPS) survey (feasibility for Project C and D), and introducing the community to the e-commerce music component would be carried out. The project team was also keen to create more community awareness about the project in another community.

Project Meeting and Development with the Community School

The project team met with the project champions, Headmaster, and teacher to discuss the intentions of the field visit, and to provide feedback on the tasks they had been given to do on the previous trip. A few challenges and constraints were revealed in relation to creating awareness of the project, and training the community. The following tasks had been done:

1. *Community training* – The teachers and project champions had managed to train eight Ntubeni teachers. In addition, a few community members who showed interest had been trained. Community training at this stage had been done in a rather sporadic manner, as the project champions had not been provided with a guided structure on how to train the community.
2. *Training Students* – The students at Mpume had been trained in educational applications, and mouse and keyboard skill games.
3. *Community Awareness:* The project champions had managed to advertise the project and encourage training in the community through making announcements at:
    - Community meetings at the Chief's residence
    - Meetings for other development projects in the community
    - The local craft centre
4. *Classroom Preparation:* The classroom that was planned to be used for training the community needed burglar bars to protect the computers from theft. The computers at this stage were stored in the headmaster's office and transferred to the staff room daily for training. The continuous movement of the computers put them at risk, and already some of the keyboard plugs were affected (sometimes they did not respond to typing) as a result of continuously unplugging the computers. The burglar bars cost approximately R2000. Mr Pakati had initially attempted to ask for funding from the director of education in the area, but this could only be put forward in the budget for the following year.

The project champions also suggested fundraising for a printer. They therefore asked if they could start charging for the training, in order to purchase a printer. The project team would search for a cheap or second hand printer that they could purchase for a reasonable amount. The teachers were not advised how much to charge for training sessions. Mrs Gxarisa suggested charging R5 per session. However, the project team indicated that the first training sessions should be free, where the community could gain a sense of awareness and interest in the ability of computers. Further training, once community interest and demand is gained, would then require payment for training sessions.

The project team had planned to visit Nqabara Secondary school, and therefore requested that Mr Pakati inform the Headmaster at Nqabara that they would be visiting the school. Nqabara Secondary School is not located within the Dwesa area. Therefore, Mr Jabe inquired which rural

areas should be targeted for training. The team discussed that it would be more appropriate to focus on the Dwesa area for the early experimental stages of the project, and subsequently explore other communities at later stages of the project. The project team needed to acquire a geographical layout of the Dwesa area (roads, shops, schools) so as to plan which schools in range to target.

Competency Training

The Dwesa ICT project adapted the Open ICDL (International Computer Driving License) course material for the Edubuntu open source platform. The Open ICDL approach has been used by the Shuttleworth foundation in training teachers at schools where they have implemented tuxlabs (The Shuttleworth Foundation, 2006). The training material is centered on Open Office applications and File management. The training material consists of three modules that were modified from the original Open ICDL course material (which were designed for computer literacy). The modified material for competency training had the following characteristics:

- Examples applicable to an educational environment to promote understanding and familiarity among the teachers during training
- Examples of screen shot pictures to illustrate and aid in understanding
- Each module is divided into 3 sections – Beginners, Intermediate and Advanced. The training was planned to focus on the beginners section, and if there was time to also train on the remaining sections. The team assumed they would train the teachers on other sections, on subsequent visits. However, training of other sections was delayed, with too much attention being given to previous training and refresher training.

The approach to training was similar to that applied in the 'Introductory training' stage. An individual project team member went through each module with a teacher on a one-to-one basis. It was not specific and planned how a trainer should train a community teacher. Instead, the trainer was meant to train the teacher in a way they thought was appropriate. This was a challenge for most team members who were quite unfamiliar with the Edubuntu platform, and how to train computer illiterate rural people.

The project team also provided *refresher training* on aspects the teachers had previously been trained on, but had later forgotten how to apply what they learnt. This supported the confidence and competence of teachers who were kept on track with the training they had received.

In order to keep track of and deal with challenges the teachers faced when using Edubuntu applications, they were provided with two log books for:

1. The logging of problems that the teachers face when using the computers, while the project team is away.
2. Logging any language challenges they face using the Edubuntu platform. If there are words on the platform that the user prefers to have in Xhosa rather than English, they could log this in the book, together with the translation preferred (this relates to research on sub-project J)

The project team also wanted to observe and evaluate the extent of community training. Therefore, the project champions were also provided with a book to register the community members who attended training. This register would be signed each day a community member attended training. The information recorded in the training register included the trainee's name, community, topics that they received training for, and the dates they attended. This would reveal the status of community training, and the project's current impact (in terms of computer literacy in the community).

Other Projects

The E-commerce Music Component

The music component (Project H) was initially introduced to the community in March 2006. The aim of this trip was to interact with community members who were interested and skilled in traditional Xhosa music, and record their talent. Mr Jabe, the project champion managed to introduce Gary to the traditional dancers from the craft centre that neighbored Mpume School. A meeting was held to discuss the intentions of the project and the contribution needed from the community traditional dancers. The traditional dancers gave a performance for Gary to record their indigenous music, as illustrated in Figure E4. The recorded music will eventually be loaded onto a website that will be hosted by the e-commerce platform.

Figure E4: Traditional Dancers at Dwesa

In order to broaden the indigenous music collected, a cultural show was held at the school for the students to show case their indigenous talent. Some youth from the craft centre were asked to participate in judging the cultural music competition, which promotes the ownership of the project. The competition was a huge success, with young children and youth giving their all (Figure E5). Apparently it was the *very first cultural activity* that had taken place at the school.

Figure E5: The Cultural Music Competition at Mpume

A GPS Survey of other Local Schools

Bradley and Martin conducted a GPS survey of other local schools, as potential WiMAX network connectivity points.

Community Awareness

Nqabara Secondary School was visited to create awareness of the project (the team had come across this school on a previous field visit). It was not clear why this school was a target, but some project members felt they should create awareness of the project, especially at secondary school level. This school is located 30 minutes away by vehicle from Mpume School, and other schools nearer to Mpume could have been targeted. Some members of the project team were quite skeptical about introducing the project to Nqabara which was located outside Dwesa, considering there were other local schools in Dwesa to explore. Nevertheless, Mr Pakati, by request from one of the project team members, had informed the Nqabara Headmaster that the team would visit the school. Therefore, in order to keep good community ties, the project team decided to visit the school. Mr Jabe stated that he had informed Nqabara School that computer training was available at Mpume, but the school had not made an effort to attend training. It was strictly decided that the team would not make promises to donate computers to Nqabara, but instead create a sense of awareness of the potential of computers, and the training available at Mpume School.

The project champions primarily presented the ICT project and team to the teachers and students at Nqabara. In fact, the field visit to Nqabara was driven by the project champions, with the team introducing the project at a limited level. The teachers and students were introduced to Open Office Writer and Calc, Wikipedia, the Gutenberg project and educational games on the Edubuntu platform.

A few students showed great interest in receiving training at Mpume. Some students actually lived in the Dwesa area, but attended school at Nqabara. Two students who had used computers in the previous schools were identified as potential youth target leaders. They were encouraged to attend training at Mpume when they could, and to invite their friends. Even though some students lived in Nqabara, the project team felt it was important to create initial awareness of the project to other areas outside the Dwesa region (future impact of the project).

1.6.4 Community Buy-in (April and May)

The community buy-in phase relates to the promotion of community participation in driving the sustainability and success of the project. In order to encourage community buy-in, the project team asked the project champions to organise a community meeting and field visit to Ntubeni to promote the project.

The Community Meeting

The community meeting was attended by the Community Chief, senior students from Mpume (Grade 9's), school teachers, parents of the students, and other members of the community. The agenda of the meeting was to present the Memorandum of Understanding/Cooperation and address any questions or comments the community had. The memorandum of understanding outlined the commitment and support of the project team for the Dwesa ICT project, and the commitment (requirements) needed from the community to support the project. The community was also given the opportunity to ask any questions regarding the project. The project champions were significantly involved in presenting the project at the community meeting, as illustrated in Figure E6.

Figure E6: The Community Meeting with a Presentation by Mrs Gxarisa (Project Champion)

The community is convinced about the potential of the ICT project, and are already in the process of supporting the fundraising of money for a printer (in the latest report, they had managed to raise R600 for the printer).

Promoting Ntubeni Participation

The project team also visited Ntubeni School to encourage the teachers to attend training, as it had been a challenge for them to attend training. The project team presented the intentions of the project, and Mr Jabe informed them about the training they could receive at Mpume. Mr Jabe emphasized that they wanted the Ntubeni staff to also be involved in training, so that they could have the same level of understanding with the Mpume community, and hence more effectively impact the Dwesa rural area.

Meeting with the Local ICT Project Representatives

The project team held a meeting with the local project representatives consisting of the project champions, Headmaster, and two community representatives. The two community representatives are community members who have attended training sessions and assisted the project champions in training. They include Neziswa Mcingi (the community youth representative) and Noluvo Mgedezi (the community representative and treasurer). The project champions informed the team that this group would collaborate together to make decisions regarding the project. The local ICT project representatives therefore form a committee representative of the community that would drive the sustainability of the ICT project. The project team would continuously maintain communication with the project champions to be updated on the decisions the representatives had made, and provide advice where necessary.

1.6.5 Technology Implementation and Community Needs Review (May, July, August)

The VSAT was finally installed at Mpume, in May 2006. This enabled the project team to test and implement ICT applications that would eventually host the e-commerce platform. This phase of the project also focused on interaction with local entrepreneurs who could potentially exploit the ICT services provided to support their business.

Training to Use the Internet

The teachers were trained on the concept of the Internet and how it could be used. Key aspects of the Internet training included how to access the Internet, how to search on the Internet (search engines), how to create and use and email account, and briefly on the issue of privacy and viruses. Furthermore, the project champions received technical training on how to connect the computers to the VSAT and log-on for Internet access.

Exploring Potential Local Entrepreneur needs

Two project team members (for projects A and B) met with local entrepreneurs to explore the different types of local business in the community, and the people involved. Most of the people interviewed were local crafts people (Figure E7). Mr Jabe and Mrs Gxarisa assisted the team in linking up and communicating with people involved in craft (mats, beads, and pots).

Figure E7: Interviewing Local Crafts People

Various interviews with local craft people revealed the current process they use to sell their products, and the challenges they have faced in marketing their product. The crafts people were informed about the potential of the project and encouraged to attend training to prepare for the next phases of the project. A later stage of the project would possibly focus on integrating local entrepreneurial activity with the ICT services available.

The WiMAX Installation

On a previous field visit, a GPS survey had been conducted to identify potential network points in the Dwesa area. Communication was maintained with some schools that had been identified as network points, to inform them of the progress of the project. At this stage, Ngwane School has been chosen as an appropriate location to first test the WiMAX installation. The project team had first provided training for the teachers at Ngwane. The computers currently at Ngwane (fundraised for by the school) were however running under Microsoft Windows 98. Therefore, training was provided on Microsoft Office applications, with which the teachers were more familiar. The team hopes to encourage the teachers at Ngwane to also experiment using the open source Edubuntu platform in the future. In order to test the WiMAX installation, one of the computers at Ngwane was turned into a router so that it could communicate back to Mpume School and use the Internet existing there. This router is run in Linux (all the routing applications are all part of core Linux), therefore no third party software is needed to acquire, install or configure the software because the installed operating system has all the necessary resources 'out of one box'. As a result, less time is spent to source the software, it does not cost the project team money, and there is a very stable robust system.

1.6.6 The Proposed Close-Out

Other phases may occur before the project is finally handed over to the community. However, data was only collected up to phase 5. There is currently no clear planned exiting strategy for the project, as it assumed that it is not an immediate issue to address, given the fact that it is an on-going research project to promote research in the two universities. The Dwesa ICT project was meant to begin in 2004 and undergo a three year cycle such that it would end in 2006. However, there were some challenges and aspects of the project that had to be dealt with before the project could finally start in 2005. The RU project leader indicates that the Dwesa project will only deliver an initial part of the e-commerce platform by the end of 2006, as requested by the stakeholders who fund the project, and then continue focusing on implementing another aspect of the e-commerce platform. It is assumed that once the project is self-sustainable and can be commercially exploited, an exiting strategy will then be developed. However, it still remains important to have a proposed strategy to hand-over the project to the community.

1.7 The Uses of ICT by the Dwesa Community

1.7.1 Current Uses of ICT in the Dwesa Project

This section discusses how the Dwesa community has made use of the ICT services they have been provided with.

Entrepreneurial Activity and Market Access: The potential of cultural and heritage tourism associated with the Xhosa tradition in Dwesa can be expanded through greater opportunities to participate in the tourism market using ICTs. The Xhosa traditional dancers in Dwesa approached Mr Jabe, a project champion, to assist them in finding out information on how they could advertise themselves via the Internet. Mr Jabe stated that, *"when they find these things (other traditional dancers) on the TV, they find out they are better than those…we have been born doing these things"*. Therefore, the Xhosa traditional dancers feel they could touch the tourism market with their more indigenous dance directly passed on from previous generations. Furthermore, traditional crafts people attend training sessions at the school, as they have shown interest in finding out where they could sell their products and at what price, in order to make a good profit in the tourism market.

Access to Education and Knowledge: Community Schools can use ICT to enhance the learning process, and improve education administration. The ICT project has especially benefited teachers and learners at Mpume, as they are provided with access to educational information which is often limited or inadequate in rural areas, and tools to assist in the education process:

- Wikipedia and the Gutenberg project have been used for educational research for the preparation of lessons. Senior students also make use of the Internet (especially the search engine Google) for research, sports and even entertainment. For example, the students were interested in researching on current affairs, and especially following up on the recent trial of a prominent politician in South Africa.
- The computers are also used to teach computer literacy for both junior and senior students, through the use of games. The Grade 1 teacher, Mrs Gxarisa, indicated that the students have shown great interest in computer lessons, as it enlightens them and gives them ideas. Mrs Gxarisa has also made the effort to explore other applications on the computer, such as word art, so that she could pass this knowledge to students and also encourage them to explore other applications. Computer literacy is not limited to students, as community members that especially consist of Grade 12 drop-outs, have made use of community training provided.

- The teachers have also made use of the Open Office suite to support school administration. For instance, the Headmaster, Mr Pakati makes use of Calc and Writer for keeping track of student records. He has also made use of the Internet to search for information to assist in school administration. The Department of Education (DOE) is planning to move toward computer based systems for schools, therefore this equipment could be used for administration of schools.
- Community members also make use of the Internet to search for general knowledge. This is especially popular among the youth in the community. They also make use of the Internet to search for possible job opportunities, information on universities, and bursaries or scholarships to support further education.

Rural Empowerment and Participation: Rural communities need to be empowered to participate in decisions that influence their welfare. In this case, they need to be empowered to also participate in wider society, especially government and other public and private institutions. The ICT project has supported this use:

- Swine fever has recently been an issue with which the South African Department of Agriculture has had to deal, by culling pigs in certain rural communities to eradicate the outbreak of the fever. As result, rural communities would be compensated for the pigs that were confiscated by government officials for culling. However, the compensation was delayed and therefore left the community questioning when and whether they would be compensated. Therefore, the community was assisted by the project team on how to search for information on this matter. They came across an article that gave them an explanation for not yet being compensated, and this made some community members interested in learning how to use email so that they could contact the relevant people. Community members later found out how far their payments for Swine fever were, which benefited them, as the community members made their way to Willowvale to collect their payments at the post office. They found out through the Internet that it had to do with problems of incorrect bank numbers, and cheques that kept bouncing.
- Various teachers at Mpume have used the Internet and email to submit work related problems to the DOE, so as to inform the DOE of the challenges they face, especially in rural communities, and hence keep them accountable.

- Community members also use email and Internet to follow up on remittances and pensions owed by government and private institutions. For instance, rural women who have lost their husbands and want to find out what is happening with their remittances, use email to contact their husband's previous workplaces (in Cape Town or Gauteng). They also need the information to find out how government and private institutions support the disabled and unemployed, especially in the case of people unemployed as a result of injury from their workplaces.
- The government funds various initiatives that support rural development. Recently an initiative to develop sports fields in rural communities has been launched so as to encourage sports and development. Community members at Dwesa have therefore used the Internet to search for information that would guide the process for applying for funding. Furthermore, the community has attempted to contact government departments that can assist in developing the roads in Dwesa that need to be upgraded after heavy rainfall.

Establishing Community Networks: ICTs can enable the growth of community networks which enable communities to collaborate in rural development initiatives. Currently, a network connection using WiMAX was setup between the Mpume School and Ngwane School. This enabled the two schools to communicate via Jabber, a chat application. Facilitating communication between different communities in Dwesa-Cwebe can increase *social capital* and bring communities together in activities toward developing tourism and other rural capital assets (more direct participation).
ICT applications such as Jabber chat and email have enabled the project team and community to communicate continuously, so as to identify any challenges and monitor the progress of the project and its impact.

Rural development administration: The community often hold meetings to discuss development initiatives. The computers at Mpume have been used by one of the committee members of the community to store information and manage community finances using Calc.

1.7.2 Planned Future Uses

This section discusses the planned uses for the ICT services provided. These planned future uses originate from the project team and Dwesa community.

WiMAX Networks with Schools: A wireless network that links Ngwane school and Mpume school has been installed. Ngwane currently has 20 computers all running Windows 98 with one that has been turned into a server. At this point, the two schools have only managed to chat online with each other via Jabber chat, for one day. However, the connection was disrupted, and is still in the process of being repaired. One of Ngwane's computers was turned into a router so that it can communicate back to Mpume and use the Internet existing there. The other schools that they plan to link up also include Nqabara, Nondoma, Mtokwane, which may later communicate via telephone using VoIP.

Tourism development: The availability of the Internet and email could simplify the booking process for the camping at the Dwesa nature reserve. Furthermore, tourism in Dwesa could be marketed using the e-commerce platform. The project champions suggest that the community could become more involved in community development through tourism. For example, during Easter or December holidays, local crafts people who would want to sell their products to tourists could collaborate with the reserve in determining how many tourists are expected to arrive during a certain period. Subsequently, they could plan how much to produce and what attractive craft to design, so as to market their products along the coast. If the tourism market boosts in the community, the project champions are planning to promote cultural and heritage tourism through traditional cafés that offer traditional meals and drinks. A website for Dwesa will market the cultural and heritage activities available. The project team also plans to develop an Internet virtual shopping mall hosted on the e-commerce platform, where goods and services offered by small and micro-enterprises in the Dwesa area may be presented and sold.

Integrating computer lessons into the school curriculum: The teachers at Mpume have shown great interest in integrating computer lessons into their curriculum. Mr Jabe indicated that he plans to approach the DOE to request for assistance in integrating computer lessons into their curriculum. In addition, he would like to require that they place a teacher with computer knowledge to assist in the approach of integration and computer teaching. However, since the teachers at Mpume are already trained and receive refresher training from time to time, the least the DOE could do is assist them through on workshop on integrating computers into the curriculum.

Local Xhosa Wikipedia for Dwesa: Local content that is relevant to a community is significant in promoting the sustainability of a project. A Xhosa Wikipedia could be used to gather information that can be shared with community members. For example, information could include local

traditions, recipes, craft, education, health *etc*. This creates a store of information that could contribute to cultural and heritage knowledge.

The BingBee Project: BingBee is an information kiosk that provides access to information via a touch pad, and a computer behind a secure window (Wentworth, 2006: 1). Once the computers in the designated room from a telecentre are more secure with burglar bars, the BingBee project will commence. This project will allow community members to access information during school holidays and weekends when the teachers are unavailable.

1.8 The Challenges to ICT Use and Implementation

The challenges faced in the project can be categorised into those faced by the community (use of ICTs), and those faced by the project team (implementation of the ICT project).

1.8.1 Challenges Faced by the Community

Infrastructure Access: These challenges are associated with the factors that have limited the effective operation of the ICT applications available:

- The cables that connect some computers are being damaged as the computers are continuously reconnected each day. Currently, the computers are stored in the headmaster's office because the designated room for a potential telecentre is not secure enough as it lack a burglar barred door. This has damaged the connecting pins on the mouse and keyboards, as they are transferred to the designated room every day for community training and use. The designated room is currently the staff room at the school. Originally, the headmaster had selected a classroom at the school for training, which was visible from where one of the teachers stayed so that she could continuously monitor the classroom for security purposes. The school received a donation to assist in installing burglar bars onto the classroom windows. Unfortunately, it appeared that the burglar bars were not safe (thick) enough to leave the computers in, as the person hired to install the bars had not done it appropriately. In addition, the electrical power in that particular classroom was faulty at times, and hence could not sustain the load of all the computers. Eventually the staff room which had more secure bars on its windows was chosen by the Headmaster. All that remains is to install a burglar barred door onto the staff room door; which seems to have been delayed because the person hired is unavailable.

- The VSAT that was to be installed by Telkom was delayed for many months. The application had been made in October 2005, but the VSAT was only installed in May 2006. Furthermore, occasionally the VSAT would not work. There was an ongoing problem of the inconsistency of electrical power supply in Dwesa which affects the VSAT and the computing hardware. However, one of the project team members indicated that the inconsistency associated with the VSAT was also an issue at a national level (for example, Internet recently stopped working for 3 days nationally), as Telkom's service will just stop working and there is limited recourse against it because it is all under contract. It becomes even more difficult to address technical problems with the VSAT which is the responsibility of Telkom, especially since it is located in a rural remote area (for example, all VSATs around the country needed to be reconfigured by Telkom, but the reconfiguration of the VSAT at Mpume was delayed, after the RU project leader continuously inquired about the problem with Telkom)

Illiteracy and Education: Illiteracy is a major problem in rural areas; therefore the project team needs to devise an initiative aimed at the inclusion of illiterate community members in the project. Currently, training is limited to those who can effectively read and write. Community members who were interviewed indicated that elderly people were reluctant to use the technology because of the challenge of reading. Furthermore, the project champion indicated that most of the community members who attended the training sessions were former students who have finished Grade 10 and are now at home doing nothing. In this case, less educated community members may assume they are incapable of using ICT. The project team needs to be sensitive to people who may be illiterate, or computer literate, and who are not familiarity at all with the technology.

Content and Language: The Edubuntu operating system fortunately has a Xhosa version for using its applications. However, when the teachers were shown this advantage, they indicated they preferred to use the English version during training. Other community trainers have still not attempted to use the Edubuntu Xhosa version available on the Dwesa computers. Initially, the teachers indicated language was not too much of an issue during training, as the teachers were able to interpret and train some community members in Xhosa. However, the training material (user manuals) available is in English, which becomes a problem when some trainees would like to refer to the user manuals provided. Furthermore, the teachers hardly used the user manuals developed by the project team to assist with training. Mrs Gxarisa stated that they only referred to them from time

to time, but could not use them in training the community. Basically, they trained the community on topics they knew well, in Xhosa. The community trainers, Pinki and Noluvo, mentioned that it was difficult to translate continuously to Xhosa, as it was a challenge to translate unfamiliar computer terms. A community trainer pointed out that some community members can read in Xhosa better than English. Therefore the project team will need to collaborate with community trainers to develop training material in the local language that can be used by trainers and trainees when necessary.

Insufficient Training and Capacity Building: The challenges associated with training are similar to those associated with illiteracy, language, and content. The project team focused on training teachers, so that the teachers can eventually train the community. Therefore, training material tended to focus on what was appropriate for the teachers, who were more educated and experienced. The approach to training was also quite sporadic with limited structure. The project team trainers did not follow any structure when training teachers, but instead trained each teacher on a one-on-one basis, simply going through the user manual. This proved difficult for the trainers, and the teachers had to be trained over a longer period in order to improve their understanding.

The project champions also indicated that there was a lack of commitment to attend training sessions among some community members. This is illustrated in the graph in Figure E8 which groups the number of times people have received training from 16 March to 4 September 2006. The group that has only received training 1 to 3 times shows a lack of commitment. In summary, 48 people have received training 1 to 3 times, 25 received 4 to 10 times, and 10 received training more that 10 times. Altogether, 83 community members have been trained at least once.

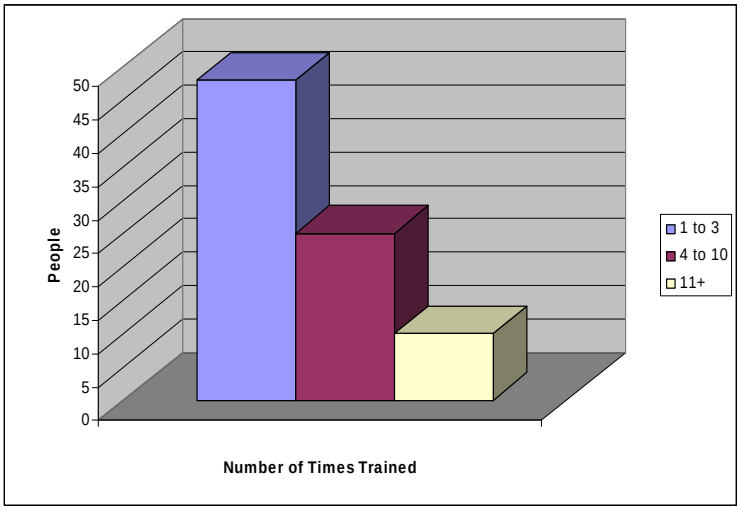

Figure E8: Bar chart of the Number of Times People have Received Training

Some community members requested the introduction of an evaluation system that certifies they have received a level of computer literacy for them to see value in the training. In addition, they are not immediately clear on how to use or integrate the ICT services to support their rural livelihood activities. A project team report indicated:

> *"Most people do not know what to accomplish with the information they get from the Internet and as a result some end up playing games on the computers. A few do know how to use computers but they do not know what else to do with the knowledge"*

This makes it essential for rural ICT projects to target existing development activities, so as to improvise how ICTs can best support these activities.

Financial Constraints: The project at this stage is significantly donor dependent. The project team has however started promoting independence in raising funds in the community through giving them the responsibility to raise funds for a printer.

Political Constraints: The project team agreed that they would not want to get involved in addressing political influences on the project. The project champions also play a significant role in the community in representing it appropriately so that the project is supported by political leaders. Originally, the ICT project was supposed to be implemented at the local shop near the reserve, which is owned by Mr Mbola, one of the board members of the Dwesa/Cwebe Development Board. However, the project team decided to implement it at the Mpume School due to its potential to be more influential in getting the community involved in using ICTs. Therefore, at a Board meeting,

which was fortunately attended by one of the project champions Mr Jabe, the members indicated that they assumed the ICT equipment was for the exclusive use of the educators and learners at Mpume. This was due to the fact that previous arrangements had been made to install the ICT equipment at Mr Mbola's shop and to have a significant involvement of the reserve. The board therefore is now totally aware that the project is intended for the benefit of the whole Dwesa community (which, to them, was seemingly invalidated by the installations at Mpume). The Board had therefore proposed to skip Mpume School in the development agenda as they were benefiting from the project. Mr Jabe attempted to rectify this misunderstanding as he indicated that the project aims to get the community involved through Mpume. The Board therefore requested that Mr Jabe give a detailed report on what had been achieved as far a getting the community involved. A project team member indicated that this, *"provides a system of accountability that is internal to the Dwesa community, besides external accountability with us"*. Some Board members may have attempted to intimidate the school, as individuals may prefer to run most development project themselves. However, the project champions gave a full report on the community's involvement in the project in addition to a report from the first trained group on their participation in the project. It is vital to get leading community members to support this project, as they can influence the sustainability or success of the project.

The Dwesa ICT project would have originally focused around the reserve and tourism which is a chief asset in the community. However, the focus has changed to the school, because of political reasons surrounding the management of the reserve. The project team feels the project exists outside the reserve now, because of political reasons, and therefore it is not clear in the immediate future how the community may use ICTs to support tourism development.

Social and Cultural Challenges: Some of the community stakeholders of the project have been reluctant to get involved significantly in the ICT project as a result of social and cultural factors. These challenges are highlighted as follows:

- *Reluctance by middle aged to elderly community members to use ICTs* – An interview with older community members revealed that they were under the impression that the ICT project was meant for younger people and they were too old to get involved. Mr Jabe also mentioned that in some cases, the adult population were not encouraging their youth to attend computer literacy training. The project team also felt that the elderly seem quite marginalized in the project, and therefore they held community meetings to make sure everyone felt they were part of the project (they need to be encouraged more to take

ownership of the project as they are introduced to new technology). However, it seems that some the elderly community members are willing to encourage their youth to attend training, but are not keen to do training themselves. They are often constrained by factors such as eyesight, illiteracy *etc.*

- *Technophobia* is a challenge in rural communities, especially when introducing new technology. The elderly may not be the only people reluctant to use ICT, as the local nurse informed the project team that community may feel challenged by the new technology, therefore training that is sensitive to the constraints of technophobia should be practiced.
- *Reluctance among some teachers to assist in the project while the project team was away* – It appeared on various trips to Dwesa that some teachers could apply the applications they had been trained in, but some were unable to use the applications on the computers. For example, Ms Mangwane and Mrs Gxarasi both knew how to use Wikipedia and applied it to their teaching, but the other teachers still did not know how to use it. Why had they not asked the teachers who knew how to use them? The project team therefore had to provide them refresher courses. Further, by observation on a field trip, Mr Jabe and Mrs Gxarisa seemed to be the only teachers involved in training the community, with assistance at least from Pinki, Andiswa and Noluvo (community trainers). Mr Jabe indicated there were some social-political reasons possibly associated with 'who takes ownership of the project' and 'who was elected as project champion'. The project team was advised to maintain communication (when the project team is away) with other teachers, and not only with the champions, so that they significantly feel part of the project. The Headmaster supports the project but still seems quite skeptical, considering it could be an expense to the school. However, the community is already aware and supports the project; therefore he makes an effort to meet the requirements of the project. The project team was advised to also maintain communication with Mr Pakati and involve him more in the project, in order to show an appreciation of the support he has given.
- A teacher at Mpume School had *misinformed the community* that the ICT project was only meant for those who had at least completed their Matric. This had quite a negative impact within the community, as people became discouraged to use the computers. The project team and trainers from the community attempted to encourage the community to attend training again. The community trainers indicated it was difficult to encourage community members to come back for training, and they are still in the process of encouraging other

people to still attend. Bradley advised that in order to avoid such a situation, there needs to be good effective communication to community members who need it. Therefore, the right agents (target group leaders and project champions) should be elected to disseminate the right message to the community appropriately. This is quite critical in a rural setting where everything happens by word of mouth.

- *A passive attitude toward development in the Dwesa rural area* – According to Mr Pakati, *"People don't want to work"*. This may therefore limit community participation in the ICT project. However, some have shown great interest in the project. The community has also become heavily dependent on pensions and child grants, which to an extent has discouraged potential economic activity in Dwesa.
- *Time Limitations* – people in the community are often busy during the day and therefore have limited time to attend training. In some cases, people only finish their daily jobs at 5pm, and have therefore requested that training is provided between 6pm and 8pm. However, the project champions are unavailable at that time for training, as they have responsibilities to attend to after school.
- *Trust in Community members as trainers* – the youth of Dwesa have shown great interest in the ICT project, and have therefore received the most training in the community. The project champions have therefore selected them to assist as community trainers. However, the community is not confident in them as trainers because they are not teachers from the school, and hence they undermine their ability as trainers. This discourages the youth as trainers. The project champions were therefore advised to introduce the youth as community trainers, when they attend community meetings and events to market the ICT project. This would inform the community of the significant role of these trainers in the project.

Access to Computers during Weekends and School Holidays: Training has not been available during weekends and school holidays. The project champions, Mr Jabe and Mrs Gxarisa, are unavailable during those time periods, and therefore there is no access to the computers at the school (for security purposes, the computers are locked in). This has become a concern among community members, as they are restricted from using the computers. In addition, due to time constraints during the week, some community members only have free time during weekends. The champions are in the process of planning to delegate the responsibility of classes during weekends and school holidays, to community trainers, Pinki, Andisiwe, and Noluvo.

Incentive for Community Trainers: Mr Jabe indicated that there are a limited number of trainers available, which is quite challenging as they occasionally have to train many people up to 8pm in the evening. An incentive may need to be introduced to encourage the youth and other community members to assist in training, so that the project may have a larger and more sustainable impact on the community. This will also reduce the strain on project champions. The community members have suggested charging for training, not only to pay trainers, but also to account for stationery expenses in the future (paper, printer cartridge *etc.*). The project team has agreed that the community could charge for training, but they would leave the decision to the community to determine when they should start charging and at what price. The project champions live in the community and are therefore more accustomed to how much a community can afford. They have so far suggested charging R2 per training session, but the project team may advise on an appropriate cost, given their familiarity with the cost of stationery.

Distance to Mpume School: Surrounding communities have often complained of the distance to Mpume which can take a few hours to get to. This was especially a challenge for teachers at Ntubeni, which was one of the school the project team plans to influence. It is discouraging to have to walk all the way to Mpume, yet receive training for a short period. However, some community members of Dwesa who are determined have made an effort to walk to Mpume. This was attempted by an elderly craftsman who had been informed about the project over an interview with Thandeka and Naomi.

1.8.2 Challenges Faced by the Project Team and Areas for Improvement

The project team has also faced challenges associated with the implementation and management of the project in Dwesa. An interview of the project team also reveals areas for improvements they have suggested.

The Integration of Projects and Team Dynamics: Different projects make up the Dwesa ICT project, and hence it has been a challenge to collaborate the individual goals of the sub-projects with the main goals. There are diversified interests among the project team members, which has resulted in members focusing on their own projects without assisting each other toward achieving the main goal. For example, training the teachers had been the focus of the first phase of the project, but some team members had refused to assist in this important process, as they assumed it was not directly linked to their research. The integration of sub-projects needs to be planned appropriately

in order to deal with conflicting and differing goals. The project was significantly challenged in planning for field trips and activities, and there still exists room for improvement. According to Bradley, clearer stated goals and management of the goals *"would have made it (project) 10 times more successful"*. A phased approach would have been appropriate with the implementation and assessment of the project being done simultaneously. There should have been metrics (how to measure the success of the project) to identify what is required in a certain phase of the project. There are a number of sub-projects in the Dwesa project, and therefore cohesion in the project is significantly needed. A more selective approach of projects that can be integrated would also be appropriate.

The Delay of the Dwesa Community to meet Project Requirements: The project team informed the community of the requirements of the project, and the part they should play through a Memorandum of Understanding communicated to them at a community meeting. However, the project champions at Mpume have delayed in meeting requirements, such as installing a burglar barred door to house the computers in the staff room. As mentioned earlier, the transferring of computers everyday has damaged their cables. Gary has also been unable to set-up a music platform for his sub-project because the room selected to house the computers is not yet secure enough.

The Integration of the Project in Community Activities: The project team indicates that they are challenged on how to integrate the project effectively in rural livelihood activities. Naomi is still in the process of researching how to elicit community requirements for ICTs, which may eventually reveal potential rural development activities that could exploit the project.

The Challenge of Language: The project team contains some researchers who can speak Xhosa, which has proven to be an advantage in communicating more effectively in the community. However, some researchers cannot attend all field trip due to responsibilities at their institutions; therefore a translator may be unavailable. The project champions have however assisted in translating for the project team when they are available. The project team may have been more effective in collaborating with the community, as the community seems to feel more comfortable conversing with someone who can understand their language. Mr Jabe advised the team to rent a house in the community, and live among the community in order to achieve more acceptance from them (currently the project team is accommodated in tourist cabins within the reserve).

The Short Length in Time of Field Trips: A field trip usually lasts from three to seven days. On the first few days, some people in the project team have to deal with technical problems, and hence they end up not having enough time to do the planned tasks. The RU project leader, suggested that the project team needs to stay for longer periods than only a week, as it is more cost effective and provides less of an impression of being 'holiday makers'. If the project team is unable to stay for longer periods, at least a formal representative of the project team living in Dwesa could make the project more effective. A project team member indicated that a project champion alone would not be effective, as he/she may not have a comprehensive knowledge of the project. However, a project champion still needs to be educated comprehensively about the project, which may have been limited in the Dwesa project. The project champion is still key in significantly representing the project and the community.

The Politics associated with the Nature Reserve: It has been a challenge to deal with an uncooperative reserve manager, from the beginning of the project in the community. It had originally been planned to develop the ecommerce platform at the nature reserve. The project however had to turn its focus to the school, which seemed to be more sustainable and supportive of the project.

The Challenge of the Community honestly communicating their Problems: Project B aims to identify the challenges the community has faced in using computers in the Dwesa project. As community members were interviewed, they seemed to not want to inform the project team of problems they have faced using the computers, but only their problems with stakeholders at the School. They are not honest about problems they face in using the computers as they do not want to impose a negative attitude about the project. Apparently, it is good practice in their culture to not show negativity toward the project which will benefit the community.

2. Rhodes University Mathematics Education Project (RUMEP) Case Study

2.1 The Project Context

RUMEP operates within the Eastern Cape (EC) Province of South Africa, focusing on supporting the Primary Mathematics education in the area. The Eastern Cape is known to be the poorest province in South Africa, which has a need for development in the area (Sainsbury and Brown, 2005b: 1). It is characterised by sparsely populated and isolated communities that exist in extremely remote areas. The communications and transport infrastructure are weak, with roads being primarily dirt roads.

The quality of education in the Eastern Cape has dropped in the past years. The Eastern Cape school system is characterised by a large number of smaller schools, especially at primary level (Human Sciences Research Council, 1998). The conditions of these schools were reflected in 1998 statistics developed by the HSRC (1998):

- A substantial percentage of schools needed repair, and were found to be without basic infrastructure such as telecommunication, electricity, water, and general education equipment and materials
- Many of the schools also had no textbooks
- The learner : classroom ratio in the former Transkei was very high, exceeding 60:1
- The learner : teacher ratio was also high, with certain areas exceeding 40:1
- A high percentage (more that 30%) of over-aged learners (three or more years older than the average grade)
- Only 49% of the learners in the Eastern Cape passed their matriculation examination in 1996, hence placing the province seventh of the nine provinces

Government has therefore developed initiatives to improve the system of education in the Eastern Cape.

RUMEP specifically focuses on Mathematics education. There has been a significant drop in the pass rate of Mathematics in the Eastern Cape, which has put this province at the bottom of the list (RUMEP, 2006a). Furthermore, a small number of students write Mathematics examinations in the higher grade. According to RUMEP, mathematics education is a top priority in the Eastern Cape, as

the changing democratic society of South Africa requires that student become mathematically literate to participate effectively in a technological society. The Eastern Cape Department of Education Report (2006) indicates that improving teaching and learning at EC schools is vital and challenging. Very few learners choose the subject, and of those who do, only a few actually pass (in 2002, only 1334 learners passed). Therefore, mechanisms to improve the education of mathematics, especially in the EC, are essentially needed to support and contribute to education development, and hence rural development at large in communities.

2.2 Introduction to the RUMEP ICT Project - MathsNet

2.2.1 RUMEP

The Rhodes University Mathematics Education Project (RUMEP) is a Non-governmental Organisation linked to Rhodes University that started in 1993, with the main purpose of supporting mathematics teachers in disadvantaged schools of rural and peri-urban areas of the Eastern Cape. It is a project sponsored by the Absa Foundation, Anglo American chairman's Fund, Anglo-Gold, Anglovaal Industries, D G Murray Trust, Ericsson, Foschini, Shuttleworth Foundation, Standard Bank, Zenex Foundation, Eastern Cape Department of Education (Bursary Funding for Mathematics Literacy) (RUMEP, 2005: 9). The main aim of the project is to improve the teaching and learning of mathematics in primary and secondary schools. RUMEP therefore works with rural mathematics teachers to develop their professional skills and their content knowledge. The approach of RUMEP is to work in partnership with teachers to (RUMEP, 2006a):

> *"inspire innovative methods of teaching which encourage children as 'active mathematical thinkers'; building on their individual skills and knowledge, encouraging them to employ their own methods to solve problems, ask their own questions, and generally make the learning of mathematics a more pleasurable and meaningful experience"*

The major components of the RUMEP intervention in mathematics education in the Eastern Cape include:

1. An accredited, in-service, professional development programme (Advanced Certificate in Education (ACE) in Mathematics and a Bachelor of Education In-service), providing teachers with the opportunity to improve both their pedagogical and mathematical content knowledge and skills. The ACE was developed in response to a request by the Eastern Cape Department of Education to provide in-service teacher training for the new FET subject of Mathematical Literacy.

2. RUMEP develops resource material and teaching aids for the teaching of mathematics at schools.
3. RUMEP monitors and evaluates the impact of its programmes on teachers and learners.
4. The RUMEP Collegial Cluster / MathsNet Project, which focuses on developing self-supporting communities of mathematics teachers who take responsibility for their professional growth.

The components of the RUMEP intervention are summarised in Figure E9.

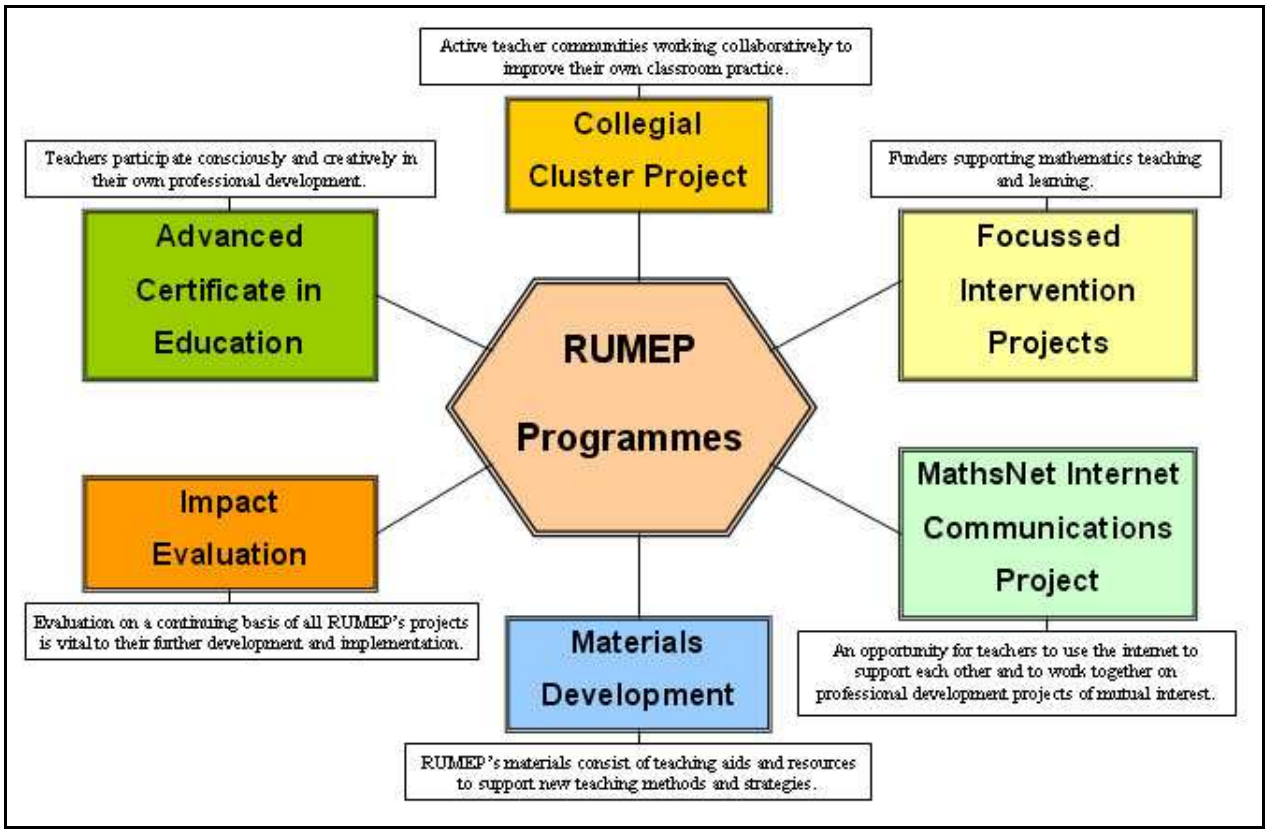

Figure E9: The Components of RUMEP's Intervention (RUMEP, 2006b)

The ICT aspect of RUMEP specifically supports the Collegial Cluster Project. The Collegial Cluster Project "facilitates the formation of self-supporting communities of Mathematics teachers, whose aim is to improve their own professional practice and to work together as agents of change and development in their own communities" (Sainsbury and Brown, 2005a: 2). The cluster consists of Mathematics teachers from different schools in the community. The MathsNet ICT project supports some of the clusters associated with RUMEP.

2.2.2 MathsNet

MathsNet is an ICT project in RUMEP that supports the professional development and work of teachers in the collegial clusters. The MathsNet project first started in 2002; therefore it has been operating for four years. Out of the fifteen RUMEP clusters, the MathsNet project has set up computers and printers in twelve clusters. This is illustrated in Figure E10, where clusters that have computer icons next to them are clusters which have received computers from MathsNet.

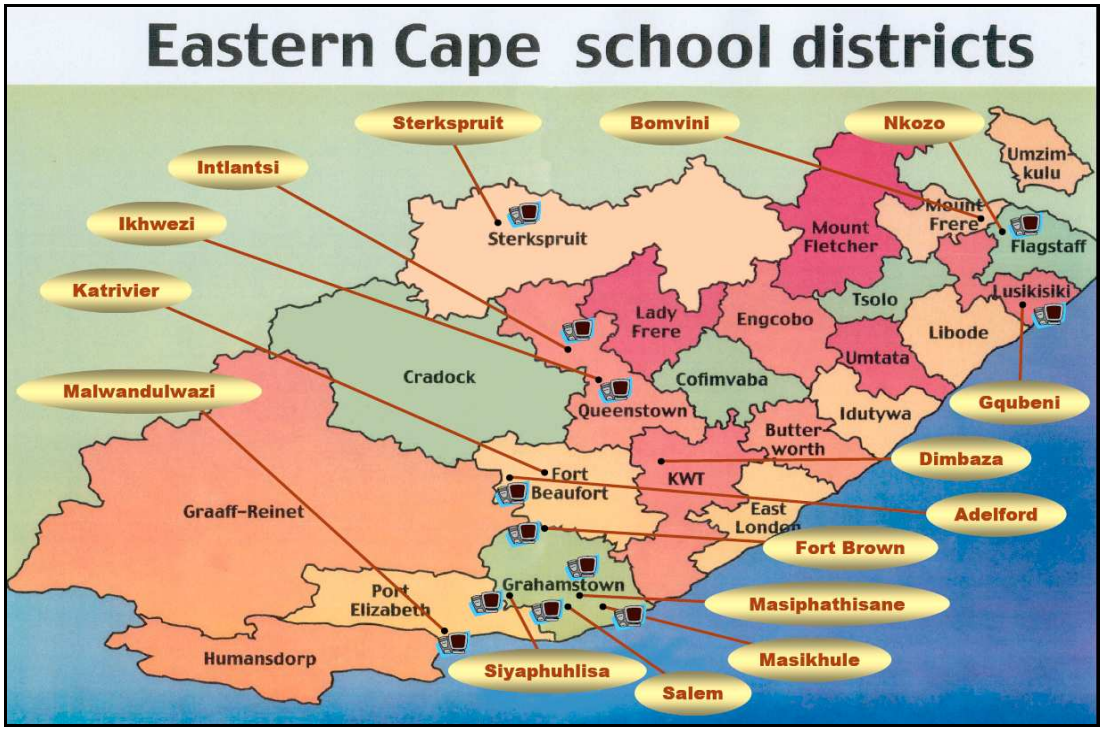

Figure E10: RUMEP Collegial Clusters and MathsNet Computer Locations (RUMEP, 2005: 37)

According to Sainsbury and Brown (2005a: 2), MathsNet is aimed specifically at teacher development, and not at introducing computers to schools and children. Therefore, mathematics teachers use computers to improve their teaching practice through cooperative work and learning. Teachers are equipped to create and adapt mathematical resources for themselves, such that they can be shared for further development of other Mathematics teachers, and clusters. However, it is important to note that the computers are not necessarily the focus of the cluster project, but are viewed as a supportive tool to be continuously operative in achieving its goals.

MathsNet focuses on Mathematics teachers as RUMEP is a Mathematics funded project. Nevertheless, if a Mathematics teacher is in a school and part of a cluster, eventually the other

teachers (who teach other subjects) will also gain through creating teaching resources. However, RUMEP focuses on mathematics teachers as there are other development projects that focus on other subject areas.

2.3 The Project Stakeholders

c) The teachers who are members of each RUMEP cluster

d) The RUMEP and MathsNet project team include:

Director: Dr Rose Spanneberg

Courses Coordinator: Mr Tom Penlington

Cluster School Coordinator: Mrs Fezeka Mkhwane

Facilitator Primary Schools: Mrs Thami Tokwe

Facilitator (FET Phase Schools): Mr Thomas Haywood

Mathematics Lecturer: Ms Thami Mahlobo

MathsNet Facilitator/IT Consultant: Mr Mark Sainsbury

The Community Teachers: Those who are members of the community cluster

2.4 Project Objectives

The overall objective of RUMEP is:

- To improve the Mathematics teaching and learning in schools, especially in deep rural schools in the Eastern Cape Province, through various programmes of RUMEP intervention

The objectives of Mathsnet are:

- To promote cooperative work and professional development in the existing clusters
- To enable the creation of varied and professional teaching resources
- Enhance RUMEP's interactions with the clusters
- Add to the confidence and skills of the teachers involved with RUMEP

MathsNet aspires to become one of the tools regularly used by the clusters. The goals of training and support provided are to develop (Sainsbury and Brown, 2005b: 4):

- *Computing Skills*

  Offer the teachers the opportunity to learn computer skills and to become confident and competent computer users.
- *Routine Practice*

Enable the teachers to make use of the computer as one of the routine tools of their professional practice.

- *Collegial Professional Development Community*
  Enable the teachers to use the MathsNet infrastructure so that they can take part in and benefit from the knowledge and experience of all of the teachers who are linked to the distributed professional community that MathsNet supports.

2.5 ICT Applications Used

Even though the ICT application and equipment are left at each cluster, they still remain the property of Rhodes University. Repairs and replacements of the equipment are carried out by Rhodes University approved personnel. The ICT applications and equipment used in the implementation of MathsNet at each cluster include:

2.5.1 Hardware

- One Computer per Cluster
- One Photocopier/printer per Cluster
- Four Laptops (only available during training so that teachers do not crouch up on one computer)
- Internet Access

2.5.2 Stationery

The running costs are borne by the cluster, however initially they are provided with 2500 paper sheets and one full toner cartridge installed. The other stationery the cluster has to obtain themselves include:

- Paper for photocopying/printing
- Replacement toner for the photocopier
- Replacement printing drum for the printer
- Electricity costs
- Telephone costs (including Internet costs)

2.5.3 Software

- Microsoft Windows operating system
- The Microsoft Office Suite – Word, Excel, PowerPoint, and Access

- Microsoft Internet Explorer

2.6 Phases of the Deployment of the MathsNet Project at a Cluster

2.6.1 Cluster Project Proposition

This phase describes the initial proposal for a MathsNet project at a particular cluster. The potential cluster is originally given the responsibility to set up a community of teachers. RUMEP does not significantly initiate or drive the project, but leaves it to the teachers to approach RUMEP for the support of the existing community of teachers. The community of teachers at this stage already work together as a cluster, and conduct Mathematics workshops within their community. Therefore, RUMEP is approached to consider the community of teachers in a collegial cluster programme using MathsNet.

In order for RUMEP to consider the community of teachers, intitial criteria are required to be met. The criteria are outlined as follows:

1. *An Executive Committee:* Each cluster has a committee which is elected from cluster members. A committee consists informally of a few key teachers (usually ACE students initiate) that get the project going with other teachers in the community. Normally each committee has a convenor/chairperson (voted for each year). Most communication between RUMEP and cluster is will be carried out through the convenor.
2. *A Cluster Constitution:* The constitution indicates how the cluster operates such as how it will be run, disciplinary measures, the voting process *etc.* This will assist the cluster to function effectively
3. *A Bank Account:* Funds are needed to keep the cluster sustainable, such that it is able to handle replacement costs (for example, stationery). In some cases, clusters have to fundraise to keep the cluster effectively operative.
4. *A Resource Centre:* for housing the cluster and its resources. This is specifically important for the MathsNet project to house the ICT equipment. The resource centre should also be secure and central to teachers that make up the cluster.

Once the collegial cluster application has been reviewed, and the objectives and criteria of the cluster are clear, the individual cluster is considered for a field visit to further explore its feasibility for a project. However, the cluster needs to be significantly functioning within the community before it can receive a computer, as the focus of RUMEP is not on the ICT itself, but the

professional development of the cluster and teachers. Once this is established, the cluster is then assessed for the feasibility of the MathsNet project.

2.6.2 Cluster Assessment and Feasibility

This phase of the project is associated with determining the feasibility of the cluster and its resource centre for the deployment of the MathsNet project. Two assessors are sent to the cluster location. These assessors consist of the MathsNet Facilitator (Mark Sainsbury), and the Cluster Coordinator (Fezeka Mkhwane). The MathsNet Facilitator assesses the suitability of the resource centre and the cluster for the project. On the other hand, the cluster coordinator supports this assessment by establishing the preparedness and continuous operation of the cluster in terms of their ability to function well (through regular meetings to discuss cluster issue). A 'Cluster Hardware Preparedness Rating' checklist is filled in by the assessors to collect data for the final evaluation of the cluster. The checklist criterion that is to be evaluated includes:

1. Physical assessment of the cluster site
2. The characteristics of the cluster community
3. The management of the cluster
4. Professional development in the cluster
5. Computer skills in the cluster

In addition to observing the cluster against checklist details, the cluster executive committee is interviewed for further information, such as their plans for the cluster, what they are expecting to have achieved with the cluster programme, and the reasons for not meeting some criteria.

Altogether, an observation of the cluster and an interview with the committee is marked against the checklist for evaluation. The assessors evaluate the checklist either based on other clusters that are being evaluated, or on past evaluations. The evaluation can last up to one month depending on how many clusters have applied for the project, as all clusters have to be visited. Nevertheless, the assessors keep the clusters informed about how the decision process is progressing.

2.6.3 Pre-implementation planning

This phase is associated with identifying activities, tasks, and plans to allocate adequate resources for a specific cluster that has been selected for the MathsNet project. Once it is established a cluster has a secure and electrified resource centre, the checklist is looked at to identify any additional equipment the resource centre may need to accommodate the ICT hardware. Extra equipment

usually needed includes a desk and chair, an adaptor, extension cables *etc*. The computer and printer are also prepared and installed with the necessary software for implementation.

In the case where a cluster will be connected to the Internet, the MathsNet facilitator plans and arranges for an Internet Service Provider (ISP) for the cluster. Currently, all Internet costs are paid for by RUMEP, but eventually arrangements will be made with the cluster to share the Internet service costs, once they are accustomed to the use of the Internet (it is still a new aspect of the project). RUMEP plans to pay one year's Internet service provision, of which later on, the cluster will pay for Internet services themselves. An example of a reasonable ISP that has been contacted is ISAT (Internet Services And Technologies), who can provide Internet connectivity for the whole province (RUMEP, 2005: 43). This provides a number that is the equivalent of a local call anywhere, hence cheap Internet access. RUMEP can therefore coordinate connections through one ISP.

The MathsNet facilitator also plans for the initial training of the teachers. The computer skills at the cluster that was assessed in Phase 2, will determine what kind of training to focus on. A structure is developed for training the teachers at the clusters. A date and time that is appropriate for the teachers and facilitator is arranged and scheduled beforehand. Training usually takes place one to two consecutive afternoons for two to three hours.

2.6.4 Cluster Implementation

The planned tasks and activities are implemented in this phase of the MathsNet project. The ICT equipment is installed and set up at the cluster resource centre as planned. Before this is done, the cluster committee is presented with an Electronic Agreement Form regarding the use of the equipment, maintenance, and running and replacement costs (paper, printer toner, telephone costs). This agreement is signed by both the collegial cluster and RUMEP (the Director and MathsNet facilitator). *Maintenance of equipment* is carried out by Rhodes University approved personnel only, under its standard maintenance contracts. Any malfunctions must be communicated to RUMEP, who will arrange to have the equipment repaired. The computer equipment is owned by Rhodes University; however, the cluster is responsible for replacement and running costs as outline in section 2.5.2. If the computer is being abused or neglected, it is confiscated and given to another cluster that can use it more effectively. The cluster is responsible for keeping the project sustainable, such that if funding runs out they are capable of keeping the cluster functional.

Cluster Training

The MathsNet Facilitator conducts training workshops at the cluster when the computer and printer are initially set up. The aim of training is to develop computer literacy among the teachers in the cluster, such that they can become a self-sustainable community of teachers (Sainsbury and Brown, 2005b: 5). In this case, the cluster can independently experiment and learn different applications that support the professional development of mathematics teaching in rural and peri-urban communities.

Most teachers in the cluster are initially trained when the computer is set up. It takes place one to two consecutive afternoons for two to three hours. Training in this case is continuous and not a once off process. The teachers are trained on an on-going basis that is dependent on the cluster visits. According to the MathsNet facilitator, the new clusters are visited nine times a year, while the older clusters that have been operating longer are visited two to four times a year. The older clusters are recognised as being more established and have been able to take more control and ownership of the project. On each visit, the teachers are trained on a new topic, and in the case of new clusters, are provided with refresher courses as they tend to easily forget what they had previously learned. Some of the teachers in the cluster may have also received training through the ACE programme held at Rhodes University.

The teachers are provided with training on Microsoft Word, File Management, the Internet and Email. The training is specifically related to teaching mathematics – for example, referencing exercises, searching for Mathematics resources on the Internet, creating class lists, and completing web-hunts as part of ACE exercises. MathsNet is still in the process of training teachers how to use Microsoft Excel.

Initial training begins with an introductory computer literacy course. Teachers are introduced to the basic parts of the computer, so that they do not feel intimidated by the technology (hence dealing with Technophobia). This is important, as approximately sixty of the eighty teachers trained during 2005 had never used nor even seen a computer before. The introductory training also aims to give teachers confidence in the technology, which influences their buy-in to the project (Sainsbury and Brown, 2005b: 5). Therefore the first training workshops focus on alleviating the intimidating task of learning to use the computers. These first few workshops focus on specific skills and functions, which are applied to developing a teaching resource.

A few (usually one or two) teachers in some clusters are fairly computer literate before receiving training from MathsNet. These teachers may have either received previous computer literacy training at a former school they taught at or through the ACE computer workshop. Other teachers also have their own computers at their homes. The approach to training these teachers differs from those who are not literate. The MathsNet facilitator therefore identifies and assesses the training needs of the teachers so that he trains them in content that is relevant and new to them. Training tends to focus on applications that are relevant such as Microsoft Word and Excel. However, the MathsNet facilitator is exploring other educational applications like the Edubuntu Open Source Platform. The assessment of teachers' needs has significantly added to the facilitator's training content and material as he becomes more aware of their needs in relation to mathematics content. The assessment process is however quite informal, and the facilitator indicates that he is in the process of formalizing the questions and requirements of teachers, such that a more formal project training improvement cycle is developed. The teachers are also assessed continuously on their level of skill attained. The general skill level is assessed, whereby the facilitator informally takes notes on training observations and common questions asked by teachers. An individual assessment is not necessarily done for each teacher, but feedback on the progress made by each teacher is occasionally given.

In the case of computer illiterate teachers, they were originally given a reflection sheet to assess their skill level and elicit their needs of the MathsNet project. However, this exercise was not as effective as the assessment of teachers who were already computer literate. The teachers who had only received a limited amount of training were not as familiar with the technology, and were therefore unable to indicate their needs from the project. Therefore, the reflective sheet is only given to teachers at a later stage of their skills development, when they are more familiar with the technology to identify their needs in developing teaching resources.

MathsNet adapts a *Train-to-Train* approach when training clusters. The project specifically aims to attract skilled teachers into the collegial cluster programme (Sainsbury and Brown, 2005a: 5). Ideally a core of skilled teachers at each cluster can share their knowledge. Currently, local experts at each cluster run Mathematics and computer workshops for other teachers. *Local experts* assist and train other teachers, especially to express computer concepts in English and translate them in Xhosa. In some clusters, teachers arrange a time with the expert teachers to do training. Significantly, the experts therefore drive local ownership of the project as the cluster becomes self-

sustainable and controls its own activities. They play an important role in training, managing cluster resources, and continuously communicating with the MathsNet facilitator regarding resources and support. In some cases, local experts have been trained to manage basic technical problems associated with a computer. The facilitator indicates that he still plans to provide more training in dealing with common technical computer issues.

Local Content Development

The teachers are encouraged to produce mathematics material with the level of training they have attained. A complex blend of the skills that the teachers have learned enables them to produce experimental material that supports the development of mathematical teaching resources. This increases the confidence of teachers as they learn from each other and create a store of teaching resources that can support their professional development. The MathsNet facilitator collects and shares these resources and knowledge with other clusters, especially during training. Therefore, each cluster is advised to store a file of work, ideas and created solutions of teachers – this encourages more practice and development of material that could be shared (Sainsbury and Brown, 2005b: 9). Furthermore, identifying the existing community's structures, practices, experiences, and needs, and then incorporating this into the process of learning among the teachers, helps them to grasp the computer as a tool more effectively.

Monitoring and Evaluation

A continuous process of monitoring and evaluation is carried out throughout the year to assess vital components of all areas of the project. The project team is continuously informed about the needs of the cluster and how they are being met. Some clusters had to be assessed again for whether their resource centres were appropriate for being connected to the Internet.

2.6.5 Close-out

MathsNet does not necessarily have a *full* exiting strategy to hand over the project to the community. A full exiting strategy will be developed in the case where RUMEP is more likely to run out of finances to fund the project. Currently, the basic existing strategy they are hoping for, as long as there is still funding, focuses on equipping clusters (workshops and training) to effectively manage themselves (training, user administration, operating system administration *etc.*), and only call on RUMEP for support when needed. RUMEP aspires for the cluster to own the ICT project,

but they are not aiming to completely withdraw unless they are forced to. They would like the cluster to still recognise RUMEP as the most appropriate central support they could rely on for the sustainable effectiveness of the project. The MathsNet Facilitator is still in the process of developing an appropriate strategy to completely hand over the ICT project to the community cluster, should that time eventually occur in the future.

2.7 The Uses of ICT Applications Provided by MathsNet

2.7.1 Current Uses of ICT

This section discusses how the community clusters have made use of the ICT services with which they have been provided. The uses are specifically associated with enhancing education and knowledge as the project focuses on the professional development of mathematics teachers.

Professional Teacher Development: The MathsNet ICT project supports RUMEP's collegial cluster programme in teacher training and development. The education quality in the Eastern Cape rural areas has been low; therefore RUMEP has enabled teachers to access adequate resources for teaching and curriculum development. The ACE programme teachers have also made use of computers for assignments and portfolio development required in their course work. The ICT provided therefore improves teaching practice through cooperative work and learning. The teachers will ultimately share and develop work in their clusters.

Enhancing the Mathematics Education Process: The teacher make use of the computer to develop Mathematics teaching resources to enhance the learning process. Examples of these teaching resources include classroom work activities, Mathematics worksheets, and examination papers. The Internet has especially been used by ACE teachers to search for mathematical content to contribute to their lessons. In some cases, teachers teach other subjects, besides Mathematics, and therefore they have used the computers to develop other teaching resources.

School Administration: The MathsNet project has contributed to the enhancement of school administration in the community schools through the development of material for sports administration, assessment schedules and mark sheets, and report cards for student records. The cluster also makes use of the computer to store details on cluster reports, meetings, and administration.

Personal Use: The use of the ICTs is not strictly limited to mathematics education, even though that is the main focus. The teachers are encouraged to explore other uses of the computer in their spare time. Examples of personal computer use include the development of CVs, birthday cards, funeral programmes, church group records, and letters to family members.

2.7.2 Planned Future Uses

This section discusses the planned future uses of ICT in the MathsNet project. These planned future uses originate from the MathsNet project team.

Use of the Edubuntu Open Source Platform: The MathsNet Facilitator is interested in benchmarking from the Eyethu ICT Schools Project in Grahamstown that makes use of the Edubuntu platform. The Edubuntu platform was specifically designed for educational environments, and therefore there are educational applications that the MathsNet teachers could explore. However, MathsNet will have to adopt a different approach as the Eyethu programme focuses on equipping the students, while MathsNet focuses on the teachers. On the other hand, two of the clusters (Whittlesea and Port Elizabeth) are within an open source Shuttleworth Tux Lab, therefore the teachers may be interested and eventually become competent to exploit the open source platform.

A Website for Sharing Resources and Knowledge: Recently, three clusters have been connected to the Internet. MathsNet plans to promote the sharing of knowledge and resources among clusters. The MathsNet Facilitator is still in the process of training teachers to effectively use the Internet, and create a culture of communication among the clusters. Unfortunately, some clusters do not have sufficient infrastructure for Internet access (telephone, sufficient electricity), but the facilitator is looking into alternative technologies to improve access.

2.8 The Challenges to ICT Use and Implementation

The challenges faced in the project can be categorised into those faced by the community (use of ICTs), and those faced by the project team (implementation of the ICT project).

2.8.1 Challenges Faced by the Community

Infrastructure Access: Some clusters are constrained by insufficient infrastructure to implement the MathsNet project. The more rural, the more difficult it is for the project team. MathsNet project reports have outlined the following infrastructure challenges:

- Negotiating telephone access in departmental offices; resource centres are not necessarily permanent in these venues.
- Overdue existing telephone accounts; where the cluster is in a school building and the school telephone has been disconnected, new telephones are not installed.
- Resource centres in areas where no lines exist and new lines are difficult or costly to place. Telkom indicates that they cannot install telephone lines in very rural remote areas. Some clusters have been slow to apply for telephone lines as they have to manage limited funds in their cluster, and they assume the MathsNet project is an expense with little benefit gained.
- Electrification of one resource centre: connecting the new resource centre to the power outside has not been done for over a year.

Alternative technologies and satellite connections are currently being investigated for distant clusters; especially those who have problems getting telephone connections (RUMEP, 2005: 44).

Content and Language: A number of teachers struggle to use the computers because they are not sufficiently proficient in English. Teachers need to receive training continuously to grasp computer symbols and terminology. The local experts have, however, attempted to assist the teachers and the facilitator (who speaks English) in training, by translating and explaining some terminology into Xhosa.

Political Constraints: The resource centres for some clusters are located within local Department of Education (DOE) Offices. This partnership has worked well for some clusters, but other clusters are challenged by uncooperative DOE offices. The problems they are faced with include trust issues associated with office access (keys), reluctance of DOE offices to share office space, and changing management that prohibits the cluster from continuing to use the offices. The employees at the local DOE office need to understand the purpose and importance of the RUMEP project in the community. The RUMEP team has therefore advised where they can, but given the cluster the responsibility to deal with this issue.

Social Challenges: Some teachers at clusters are reluctant to use the computers provided by MathsNet for the following reasons (Sainsbury and Brown, 2005a: 5):

- *Time Constraints:* teachers complain they do not have enough time to devote to cluster activities as they have other school activities for which they are responsible.
- *Technophobia:* The MathsNet Facilitator indicated that it is initially a challenge to encourage teachers to be creative and step out with ideas to use the computers. However, if a teacher initiates personal content development, other teachers tend to follow suit. For example, a teacher created a report card which was transferable and adaptable for different grades, languages, and personal tastes. As the facilitator shared this product with other clusters, the teachers became more confident to develop their own content.

Distance: Teachers at times have to travel long distances to get to the nearest cluster. This is especially a problem in rural communities, where very few people own cars. Despite this, some teachers have made an effort to make use of the cluster as much as they can.

2.8.2 Challenges Faced by the Project Team and Areas for Improvement

The MathsNet project team has also faced challenges associated with the implementation and management of the project at clusters.

The Challenge of Language: The MathsNet Facilitator is unable to speak the Xhosa language fluently. This becomes a challenge when training teachers who are not fluent in English, especially in understanding computer terminology. Nevertheless, the local experts have assisted the facilitator by translating where they can.

Limited Mathematics Knowledge: The MathsNet Facilitator is not familiar with teaching Mathematics, and therefore it becomes a challenge for him to give the teachers relevant Mathematics examples to practice their computer skills. He only has a few examples he could use. Nevertheless, the facilitator encourages local content development within the cluster. This may be a challenge initially, as the teachers are not confident enough to development their own content.

APPENDIX F

Dwesa Community Survey Details: Schools and Clinic

F1. Report on Community Survey: Trip 1 (Pade, 2005)

a) Mr Mbole Shop

- I did not get a chance to interview Mr Mbole, but I will obtain further information about the suitability of his shop as a place to install the VSAT from the other researchers. Currently the only information I personally obtained was from observation.
- On the first day we got acquainted with Mr Mbole, to introduce him to the research team and inform him when Telkom will be installing the VSAT
- From my observation he did not seem to understand the telecentre aspect of the project and was not aware of its full potential. I do think it would be important for someone to personally explain what the ICT project was about, and the technology they were installing at his shop, especially since he is directly involved and may play a significant role in promoting the use of the technology in the community (if VSAT is installed at Shop).
- One of the researchers however indicated that the E-commerce project is currently in the first phase which focuses on field testing. With limited knowledge of the community, they are focusing now on testing what kind of technologies can be used in this rural environment. However, it is vital that awareness is promoted about the project among those directly involved, so as to get community buy-in and participation from the beginning (improves chances of sustainability)

b) Ntubeni Junior Secondary School

- School built by the community, no government funding (I think)
- ***Staff***
  - ⇒ Head Mistress: Mrs Dukwe
  - ⇒ Not sure how many teachers (I think 4) but we interviewed Ms Nikelwa Dina
- ***Infrastructure***
  - ⇒ One small main building, where part of the building has no roof. Two shacks which are the staff room and classroom
  - ⇒ There is no electricity
- ***Skill level (computer literacy)***
  - ⇒ The students had never seen a computer, but they have heard of a computer
  - ⇒ Teachers have also never used a computer

- ***Constraints***

  ICTs could play a significant role in enhancing learning among students and teachers, however there are constraints faced by the school. Mainly the fact that they do not have electricity and even obtaining funding for the implementation of solar power may be difficult. In addition, the teachers were quite bitter about the fact that they have not been able to receive any funding from the trust to build a roof for the school and assist in other limitations they face; hence political and social constraints need to be considered.

  However we still did introduce the idea of ICTs to them, and pointed out the potential collaboration with Mpume High School (about 4-5km away) whose infrastructure is more suitable for the implementation of ICTs. We also pointed out that even if ICTs would not be implemented at their school, they could still access educational information from where the technology is implemented i.e. at Mr Mbole's shop or Mpume High School, given that they have been trained to use the technology.

c) Mpume PJs High School

- This school was far more developed than Ntubeni School. Part of the school buildings were funded by the government, but most of the school's development was done through the active participation of teachers in getting the community involved. This is an advantage, as teachers could play a role in promoting use of ICTs in the community for the support of various activities, especially involving the innovative ideas of the youth.
- ***Staff***
  - ⇒ Headmaster Mr A.M Pakati (cell: 083 206 4593)
  - ⇒ 12 Teachers
- 402 Students
- ***Infrastructure***
  - ⇒ 3 blocks of buildings. 2 blocks for classes and 1 block for the staff room
  - ⇒ There is electricity
- ***Skill level (computer literacy)***
  - ⇒ The students had never seen a computer, but they have heard of a computer
  - ⇒ One teacher (Mr S. A. Xatasi) can use a computer, but currently has a temporary post at the school (might become permanent). The rest of the teachers cannot use a computer.

- ***Potential Benefits of ICTs***

  We interviewed the teachers and asked them how they thought ICTs could potentially benefit them. The benefits they pointed out included:

  - ⇒ Enhanced learning
  - ⇒ Facilitate the management of school files
  - ⇒ Access to information on different cultures for student projects
  - ⇒ Access to information on educational environments in more developed regions or countries to improve the academic process
  - ⇒ Currently they collaborate with other schools in Dwesa-Cwebe through cell phones, and therefore other ICTs could promote more effective communication between schools in the region

  Hannah also mentioned the possible implementation of a "Hole in the Wall" ("Bing Bee") project at the school, where by a computer is left at the school for students to access information and engage in educational games via a touch screen. This way, students may be able to teach themselves and experience using a computer.

  Gary was also keen to have his music studio implemented at the school as this would possibly get the community more involved through the participation of youth in producing traditional music from the area. This would be a good project to encourage local participation in tourism for development in Dwesa-Cwebe.

- ***Constraints***

  Mpume School obviously has better infrastructure than Ntubeni therefore more suitable for the implementation of the VSAT. Some other concerns that did however come up are:

  - ⇒ The training and awareness of teachers in using these technologies, but this is considered part of the project in a later phase.
  - ⇒ Access to the technology over school holidays, as other members of the community may need to use it
  - ⇒ Security is also an issue there, as some telephones have been vandalised in the area

d) Msendo Clinic (Government clinic)

- This clinic is the closest to the reserve and was financed by the Trust. According to Ms Qwatekani, there are 4 other clinics in Dwesa. These include, Nxabaga, Mbati, Gwadu and Mbozolo Clinic. Communication between clinics is mostly done through cell phones.
- ***Staff***
  - ⇒ Head Nurse: Ms Nomgqibelo Qwatekani
  - ⇒ Enrolled Assistant Nurse
- ***Infrastructure***
  - ⇒ Secure building
  - ⇒ Solar powered electricity
- ***Skill Level (computer literacy)***
  - ⇒ The Head Nurse has used a computer before, where she was previously employed

- ***Potential Benefits and use of ICT***
  - ⇒ The collection and analysis of statistics on diseases and other health challenges in the area
  - ⇒ Following up TB cases, schedules to collect sputum, so as to better control and know when patients finish treatment
  - ⇒ More efficient communication and access to information from the Dept of Health. Currently, the Dept of Health communicates through Mbashe clinic located in Idutwa. It usually takes a long time to obtain information, usually a *month*, except in the case of emergencies. The nurses have to travel long distances to obtain information
  - ⇒ In the case of patients (seriously ill) who need a doctor's treatment, patients have to travel as far as Willowvale and Butterworth. This could be reduced in cases where the doctor can communicate with the nurse on what measures to take e.g. the use of a digital camera and email for digital diagnosis
  - ⇒ The Head Nurse also works with traditional healers in the area, therefore information on natural measures for treating people could be shared locally, nationally, and possibly internationally
- ***Extra Information Obtained from Ms Qwatekani***
  - ⇒ She informed us that if the Health Department wants to launch a campaign (workshop disease prevention and treatment awareness in the area), they consult the

Headman of the community, who informs and assembles members of the community. Apparently different parts of Dwesa-Cwebe have a community Headman.

⇒ She also informed us from experience that with the introduction of new technology the community may assume that the technology is too sophisticated and hence they will be reluctant to use it, therefore close training will be required.

F2. Report on Community Survey: Trip 1 (Thinyane, 2005)

A Report on the Visit to Dwesa-Cwebe

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The primary objective of the Dwesa-Cwebe project is to develop and field-test the prototype of a simple, cost-effective and robust, integrated e-business/telecommunication platform, to deploy in marginalized and semi-marginalized communities in South Africa. The Dwesa-Cwebe area provides an ideal environment that represents the marginalized communities and that also fits the criterion established for a deployment of such a prototype.

In planning the trip to Dwesa-Cwebe, it was intended to coincide with the Telkom installation of a VSAT satellite that would provide internet connectivity in the area. One of the objectives of the visit was to get the satellite link up and running and to gain familiarity with its setup and configuration. The initial plan was to install the VSAT at Mr Mbola's shop as this provided the required infrastructure (electricity and safety of the equipment). After consultation with Mr Phakati (the head teacher of Mpume Junior Secondary School) and after reviewing the available infrastructure at the school, the prospect of installing the VSAT at the Mpume School seemed more favourable.

A detailed daily breakdown of the trip to Dwesa-Cwebe is outlined below followed by a detailed profiling of the schools that were visited in the area.

Daily Report

Wednesday:

- Left Grahamstown around 07h30 in the morning, travelling in the Condor and the Citi Golf (Hannah's car)
- Went through Fort Hare to pick up Martin and Gary

- Met up with Mr Tyityi and arranged for a meeting on Saturday at 09h00 for him to take us on a 'tour' of the Dwesa-Cwebe area
- Went to Mr Mbola's shop to introduce ourselves and to explain the intended plan of action as far as the installation of the VSAT was concerned
- Checked-in at the Reserve

Thursday:

- Went through Mr Mbola's shop to meet with him for further discussion regarding the installation.
- Made relevant phone calls to ascertain the timing of the VSAT installation by Telkom. A big portion of the visit hung on the successful installation of the VSAT as indicated earlier.
- While waiting for the 'arrival' of the Telkom technicians, we visited a school nearby called Ntubeni School. A detailed report on the school is made in the 'Dwesa-Cwebe schools' section of this report. A meeting was scheduled for the following day to meet with the 'head-teacher' of the school who was absent on the day of the visit.
- After Ntubeni we went further to visit Mpume Juniour Secondary School, where we met up with Mr Phakathi (the headmaster). After an elaborate discussion with him (which included other members of the staff) we felt that Mpume would be an ideal location for the installation of the VSAT satellite. The basic infrastructural requirements needed for the installation are easily met at Mpume and the level of enthusiasm shown by the staff was remarkable.
- We also went to visit a clinic in the area in order to ascertain the level of interest and the possibility of a cooperation in terms of housing some of the networking equipment at a later stage
- After further telephone calls, it was apparent the Telkom technicians were not going to make it on Thursday

Friday:

- Further calls were made to determine if the VSAT installation was going to happen at all
- We met up briefly with Mr Mbola to update him on the state of affairs as far as the installation of the VSAT was concerned.
- We went up to Ntubeni for the meeting that had been scheduled

- On realizing that the VSAT installation might actually not happen at all, we decided to spend the rest of the time doing a detailed profiling of the school around the area. The schools form a crucial entity in the roll-out of an ICT solution in the area, both in terms of providing the infrastructure required and in terms of possibly being involved in facilitating skills development and computer literacy initiatives. A detailed report on the schools is done in the 'Dwesa-Cwebe schools' section of this report.
- We decided to leave the Dwesa-Cwebe area early the following day and subsequently cancelled the meeting that had been scheduled with Mr Tyityi.
- Hannah and Caroline left Dwesa-Cwebe later during the day

Saturday:

- Drove back from Dwesa-Cwebe to Grahamstown and dropped Martin and Gary in Alice (Fort Hare)

Dwesa-Cwebe schools

Ntubeni School:

This is the school that is closest to the Nature Reserve but it is also one of the most dilapidated schools that we visited. There's a lack of basic infrastructural requirements at the school;

- No electricity
- Rundown buildings (one of the classrooms didn't have a roof)
- No landline telephones – extensive use of cell phones for communication
- Very high level of Computer illiteracy and English illiteracy

Although the situation looked very dire and distressful, chatting to the staff and some of the students indicated a level of optimism about the future and a fairly positive outlook towards their circumstances.

Some of the biggest issues that the school is facing are socio-economic in nature;

- There are the obvious issues in the community in terms of the cooperation with the Trust and the communication between the schools and the Trust (what seem like power struggles between the involved entities)

- There is a low teacher-to-student ratio at Ntubeni with 9 teachers responsible for about 400 students
- There is a high migration of teachers from the rural schools to the urban areas (esp. to Cape Town)
- There was a feeling of the teachers being 'without a voice' in the schools as was indicated from the story about the 'theft of fish from the Reserve by the students and the teachers not being able to say anything about it'. The issue of the snake in the staff offices (a corrugated iron shack) was also indicative of this. Even though these issues may seem farfetched as far as implementing an ICT platform in the areas is concerned and as far as we (ICT researchers) are concerned, they are nonetheless issues that are going to have the strongest bearing on the successfulness of the implementation of ICT solutions in the area. A few immediate benefits of an ICT infrastructure in the area as far as Ntubeni is concerned were identified;
- There was mentioned by the teachers that some of the course material they were utilising was old and outdated. This will be remedied by the availability of access to Internet where they could access recent teaching materials and also collaborate with other teachers in similar circumstances
- There was also a mention of minimum collaboration with neighbouring school (far less than at other schools). A basic VoIP (VoWIFI) telephony infrastructure will facilitate and catalyze the collaboration between the local schools

Mpume Junior Secondary School:

There is an availability of basic infrastructure at Mpume;

- There is electricity – not solar powered
- The buildings are in a fairly good condition – with a separate room for the staff and the head-teacher
- There is no landline telephone infrastructure in place, most communication with other schools is done via cell phones

Some of the teachers at Mpume have very basic computer literacy and there is one temporary teacher who was fairly computer literate (he stimulated the discussion with his insights on how the school could benefit from the availability of Internet access – school administration and facilitating learning). There's already a level of collaboration with the other local schools in the vicinity of

Mpume and this could be enhanced by the availability of a robust communication infrastructure in place.

The teacher-to-student ratio in Mpume is in the order of 12:402. There was also a very positive outlook among the teachers as far as embracing the ICT solutions is concerned. There was also talk of deploying some Bing Bee equipment at the school (motivated by the 'hole in the wall' project that was implemented in India). This would be undertaken by Hannah and would stimulate the students to learn about computers

In terms of the geographical position of Mpume, it is about 3 km away from Ntubeni, which works out to about 5 km from the Reserve. Mpume has line of sight (LOS) with most of the other locations of interest that we visited (mostly school) and for this reason and other reasons of infrastructural adequacy, it was determined that it would be an ideal location to install the VSAT.

Mampondweni Senior Primary School:

We got to Mampondweni Senior Primary School towards early afternoon and the school had already closed. We did however meet up with one of the teachers (Mrs Khanye Skepe) who managed to furnish us with some of the relevant information;

- There is not electricity at the Mampondweni school
- The teacher-to-student ratio is in the order of 5:300
- Cell phone usage is the predominant means of communication with the other schools

She also mentioned the migration of teachers from the rural schools to Cape Town. In her own capacity (as a teacher) she exuded a level of interest in the possibility of an implementation of ICT solutions at the school.

Ngoma Junior Primary School:

The Ngoma Junior Primary School had also closed by the time we arrived. We did however manage to meet up with one teacher who mentioned that:

- The school had electricity – solar powered
- There were 9 teachers who were responsible for approximately 400 students

- Communication between the teachers at different schools was undertaken mainly through cell phones and letters
- The teachers at Ngoma were undergoing computer literacy training under the auspices of a program that was run by the Educational DSTU.

Lurwayiso Junior Secondary School:

The Lurwayisa school has solar-powered electricity. There is a Telkom public telephone that has been vandalized next to the school and that was indicative of the apparently high level of vandalism in the area.

About three of the teachers at the school have a working knowledge of computers but the rest of the teachers and the students have very minimal literacy levels. The teacher-to-student ratio at Lurwayiso Junior Secondary is approximately 11teachers to 500 students

The school has a LOS with the Mpume school and is about 500 meters from the Lurwayiso secondary school. There is currently extensive collaboration between junior secondary and the secondary school.

Lurwayiso Secondary School:

There is solar powered electricity at the school. The school itself is made up of 5 teachers and approximately 300 students who are accommodated in 3 classrooms and 1 staff room. There school has 3 computers running Windows 2000 and there's a basic level of computer literacy at the school. The computers are, however, currently not being utilized for academic purposes (i.e. administratively or for facilitating learning); it appears there's a rather extensive use of them for extra-curricular activities.

The issue of high vandalism rate was also cited as an area of concern as far as ICT equipment is concerned.

The school also has a LOS with Mpume and would invariably benefit from a robust communication infrastructure as the current communication is undertaken solely via cell phones.

Mendwana Junior Secondary School:

The school has solar powered electricity. The Telkom public telephones have been vandalized and are not working any longer. There is a very high level of computer illiteracy at the school both from the teachers and the students. There is however a level of enthusiasm towards implementing ICT solutions, similar to what was observed at other schools in the area.

Currently there are 10 teachers who are responsible for 370 students. Cell phones are the current means of communication between the school and others in the vicinity.

Other Observations:

Further observations were made on the Dwesa-Cwebe visit;

- Migration of the 'productive' members (teachers, youth) of the community to Cape Town
- There was a recurrence of the concern, from the teachers we chatted to, about the generally passive attitude of the people in the community towards development. One of the head-teachers put it blatantly by saying "people don't want to work". This is of course the exciting challenge of trying to utilize ICT solutions in order to stimulate people to work and to encourage economic activity in the locality. It is also indicative however of the underlying attitudes and the worldview around the area.
- The prevalent world-view in the area of Dwesa-Cwebe is the animist traditional African worldview. While it is not within the scope of this report to discuss the tenets of that worldview, an understanding of it is crucial as it directly influences people's attitudes towards change, work, learning, view of technology, *etc*. It is these 'soft' issues that underlie the successfulness of the ICT endeavours that are undertaken in the area.

Conclusion

My involvement in the Dwesa-Cwebe trip was also to determine the possibility of undertaking a doctoral project focusing on the area. Currently the possible fields of research will be in eLearning solutions for the marginalized communities, mobile learning solutions harnessing the proliferation of cell phones in rural areas, wireless Internet connectivity. There is a definite possibility of undertaking research in Dwesa; the exact research topic is yet to be finalized.