Cape Peninsula
University of Technology

AN INTEGRATION OF COMMUNITY INFORMATICS AND ENTERPRISE ARCHITECTURE IN ICT PROJECTS FOR RURAL COMMUNITIES: A CASE STUDY IN GRABOUW, WESTERN CAPE, SOUTH AFRICA

by

DAVID JOHN MZWANDILE MAKOLA (202086992)

Thesis submitted in fulfilment of the requirements for the degree

Doctor of Technology: Information Technology

in the Faculty of Informatics and Design

at the Cape Peninsula University of Technology

Supervisor: Professor AC de la Harpe

District Six Campus, Cape Town

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DECLARATION

I, David John Mzwandile Makola, declare that the contents of this thesis represent my unaided work and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it expresses my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed _____ **Date** **4 July 2020**

PROOFREADING CERTIFICATE

4 July 2020

DAVID JOHN MZWANDILE MAKOLA
Faculty of Informatics and Design
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RE: CERTIFICATE - TECHNICAL EDITING AND PROOFREADING OF DOCTORAL THESIS

I, the undersigned, herewith certify that the technical editing and proofreading of the DTech thesis of David Makola, entitled *"AN INTEGRATION OF COMMUNITY INFORMATICS AND ENTERPRISE ARCHITECTURE IN ICT PROJECTS FOR RURAL COMMUNITIES: A CASE STUDY IN GRABOUW, WESTERN CAPE, SOUTH AFRICA"*, has been conducted and concluded.

The finalised thesis was submitted to David on 4 July 2020 and cc'd to Prof André de la Harpe.

Sincerely

Professor Annelie Jordaan
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ABSTRACT

Despite the vast and well-established Information System (IS) field research, various supporting disciplines and research fields that generate innovative socio-technical ICT projects, socio-economic development, and sustainability in rural and underserved communities are still elusive. The research explores the integration of enterprise architecture (EA) discipline and community informatics (CI) discipline to develop a framework, EA4CD, that can develop, deploy and implement community-based ICT projects for rural and underserved communities. The participatory development theory (PDT) theoretical framework anchors this research as it strengthens the collaboration between the community and the government in development strategies. CI defines a robust and strategic position, which encourages social cohesion and drives community services' design and implementation. While the government EA addresses issues of alignment, integration, and agility within the service departments.

Rural and underserved communities face unique challenges of prescriptive knowledge when implementing community-based ICT projects. Design science research (DSR) methodology fulfils this prescriptive need. Besides, the interdisciplinary, interpretive qualitative study — seeks ways to respond to the synergies among respondents to create good ideas. A purposive, convenient, and snowball sampling strategy adopted in this study provided information-rich cases that helped develop and implement community-based ICT projects in Grabouw. A sample size of 33 respondents participated. The transcribed interviews were analysed using abductive grounded theory principles. This research's primary finding is that there is a dire need to ensure that the rural and underserved communities participate in the development, deployment, and implementation of community-based ICT projects that promote community development.

The research output is an EA4CD framework that integrates CI and EA tenets to benefit rural and underserved communities in implementing community-based ICT projects. This study is significant to the Grabouw community in addressing the difficulty experienced in building the optimum infrastructure, creating a developmental and innovative environment, and utilising the e-commerce opportunities that the Western Cape government provides to improve the community's socio-political-economic situation.

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DEDICATION

For Luyanda, Ayanda, Sihle, Monde Jr, Ziyanda, Lihle, Abukwe, and Khanya

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GLOSSARY / ACRONYMS / DEFINITIONS

Terms	Acronyms	Definition
Activity Theory	AT	Activity Theory (AT) defines “a purposeful, mediated, contextual dialectic activity relationship between the subject (the doer) and the object (the thing being done) producing a desired outcome” (Hasan, et al., 2017:275).
Actor-Network Theory	ANT	Actor-Network Theory (ANT) is a form of social constructivism that rejects the idea of a social determination of scientific knowledge, but embraces people, objects and organisations collectively referred to as actors, or sometimes actants (Callon, 1999; Latour, 1986; Law, 2009).
Centre for e-Innovation	Ce-I	The Centre for e-Innovation is a unit situated in the Premier of the Western Cape Department, which is responsible for providing ICT-related services within the Western Cape Province (Vosloo & Chigona, 2010:2).
Community Development	CD	Community Development (CD) is a process that empowers community members with skills to effect change that will bring a better life to all the community members (Bin Zaini, 2018:18).
Community Informatics	CI	Community Informatics (CI) refers to an emerging interdisciplinary field of investigation and practice by academics, practitioners and activists who are concerned with the critical usage of information and communication technology (Williams & Durrance, 2009:27).
Community Informatics Research Network	CIRN	Community Information Research Network (CIRN) is an annual international conference of researchers, practitioners and policymakers concerned with enabling communities through the use of information and communications technologies (ICTs) and specifically with research and practice in community informatics and community networking or community technology practice (Day, 2011:3).
Critical Social Theory	CST	Critical Social Theory (CST) is a radically different theory, which takes into account the human construction of social forms of life and the possibility of their recreation (Horkheimer, 1937; Ngwenyama, 2005).

Terms	Acronyms	Definition
Design Science Research	DSR	Design Science Research (DSR) is a pragmatic research paradigm promoting the creation of artefacts to solve real-life problems (Simon, 1996; Hevner et al., 2004; Prat et al., 2014).
Enterprise Architecture	EA	Enterprise Architecture (EA) is the process of modeling all aspects of the organisation (i.e. the enterprise) to ensure that services, processes, applications, information, data, technology, locations, people, events and timelines are all aligned with the enterprise goals and objectives to execute a business plan effectively (Lapalme, 2012:38).
Free and Open Source Software	FOSS	Free and Open Source Software (FOSS) is the free usage of software, sharing and continually improving the source code at no expense (Brovelli et al., 2016:2).
Information and Communications Technology	ICT	Information and Communications Technology (ICT) is the combination of information, communication and technology to enable and to empower those who are engaged in using it (Heeks, 2012:25).
Information and Communications Technology for Development	ICT4D	Information and Communications Technology for Development (ICT4D) is a discipline within ICT with the purpose to uplift the social, economic, and political development of the poor and marginalised people and communities (Singh et al., 2018:6).
International Conference on Information Systems	ICIS	International Conference on Information Systems (ICIS) is an annual prestigious international conference of IS academics and researchers.
Integrated Development Plan	IDP	An Integrated Development Plan (IDP) is local government legal developmental document with an overall framework for the usage of the land, delivery of community services, and the protection of the environment. The municipality executive committee is responsible for producing and revising the IDP document after every five-year cycle.
Millennium Development Goals	MDGs	Millennium Development Goals (MDGs) are the United Nation's initiative of eight goals, ranging from extreme poverty rates to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015 (Sachs, 2012:2206).

Terms	Acronyms	Definition
Multi-purpose Community Centres	MPCC	Multi-purpose Community Centres (MPCCs) are "widely seen as a key measure of offering a wide range of services needed by the communities to the communities, and empowering communities to bring about their own development" (Jacobs & Herselman, 2005). MPCCs are also known as Thusong e-Centres.
Over-the-top	OTT	Over-the-top (OTT) applications or apps provide services that come **over the top,** which are typically related to media and communication and are generally, if not always, lower in cost than the traditional method of delivery (Gillwald et al., 2018:97).
Participatory Development Theory	PDT	Participatory Development Theory (PDT) is the building of mutual trust between participants during the significant construction of a project, empowering each participant to share and take part in decision-making (Dearden & Haider Rizvi, 2008:82).
Underserved Community	UC	An Underserved Community (UC) is a community of people, including rural or urban communities, whose demographic, geographic, or economic status impede access to necessary services (Philip & Williams, 2019:306).
Rural Community	RC	A Rural Community (RC) is a community where people are living in a serene, rustic and isolated countryside geographical area located outside major towns and cities, often characterised by farmlands, woodland forests, plains, deserts, and grasslands with people living far apart from one another (Du, 2011:664).
Sustainable Development Goals	SGDs	Sustainable Development Goals (SDGs) are seventeen (17) goals adopted by the United Nations General Assembly in 2015, addressing the economic development, social inclusion and environmental protection by 2030 (Sachs, 2012:2208).
Theewaterskloof	TWK	Theewaterskloof (TWK) is a municipal area in the Overberg district of the Western Cape, South Africa. It comprises the following rural towns: Botrivier, Caledon, Genadendal, Grabrouw, Riviersonderend, Greyton, Tesselaarsdal, and Villiersdorp.
Thusong Service Centre	TSC	Thusong Service Centre are similar to MPCCs.

Terms	Acronyms	Definition
United Nations	UN	The United Nations (UN) is an international organisation formed in 1945, after the Second World war, with the purpose to address socio-economic, cultural or humanitarian problems.
Western Cape Government	WCG	The Western Cape Government (WCG) is the provincial government of the Western Cape province, designed to serve the needs of the people residing within this province.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The World Bank Annual Report (2017) shows that 63% of the world's population live in rural areas and more than 70% of the rural population experience poverty. Almost half of the world's population, approximately three billion people, continue to live in poverty, living on less than 2.50 US dollars a day (World Bank Annual Report, 2017). Notwithstanding the United Nations (UN) sustainable developmental goals (SDGs) of tracking progress in reducing poverty, protecting the environment, and ensuring peace and prosperity among nations by 2030, rural and underserved communities demonstrate an enormous amount of work to be done to ensure compliance. The remaining period of approximately eleven years (2019-2030) raises questions and doubts on whether the SDGs will be met or not.

The UN implemented time-specific (2000-2015) and critical millennium development goals (MDGs) that address poverty, hunger, disease and inadequate accommodation, while promoting health, education, gender equality and environmental sustainability. The UN looked upon information and communications technologies (ICTs) as enablers to expedite the MDGs (Hameed, 2006). However, in 2015, it was clear that the MDGs would not be realised. New subsequent goals known as sustainable development goals (SGDs) were ratified, shifting the target date to 2030. Similar to MDGs, SDGs called for expedient uprooting of vestiges of poverty, protecting the planet and ensuring that all people in the world enjoy peace and prosperity. Within this agenda, ICT projects have been envisaged as ubiquitous innovation enablers cutting across the full socio-economic spectrum (García-Muñiz & Vicente, 2014).

Over the past decade, researchers, practitioners, and government agencies have understood that community-based ICT projects positively influenced developmental studies and community development in better understanding the complex multi-disciplinary approaches (Heeks, 2008; Yalegama et al., 2016; Mtika & Kistler, 2017; Tucker, 2017). This contribution has led to a better understanding of social, economic, political, technological and cultural aspects of societal change, particularly in developing countries and more specifically in rural and underserved communities. Researchers, through the World Bank as well as various UN agencies, established a discipline known as Information and Communications Technologies for Development (ICT4D), trusting that ICT strategies can turnaround the inefficient government administrations lacking in the provision of services such as healthcare and education (Avgerou, 2017). Despite the ICT4D advances, sustainability of ICT

projects remain an issue and that transformation of socio-economics of communities of the world based on technologies is a best partial and mostly temporary (Meurer et al., 2018).

Despite all the initiatives, a significant number of ICT projects in developing countries failed. According to Heeks (2002, 2005), one-third of ICT projects were a total failure, with one-half a partial failure. Haikin and Duncombe (2013) argue that these failures provide little room for the success of ICTs in rural and underserved communities. Dwivedi et al. (2014) also present a corpus of failed information systems (IS) projects in developing countries.

Despite all these failure, the rural and underserved communities ICT project failure were severe (Brown & Mickelson, 2019; Chipidza & Leidner, 2019; Egbe & Bethel Mutanga, 2016; Heeks & Ospina, 2019). Sparsely populated of far-out areas of small towns, or underserved communities in large settlements of densely populated urban towns, or cities of developing countries are fighting for survival. These communities either do not have access to ICTs to enable their lives or hold on to obsolete or outdated technology to sustain their livelihood. In numerous cases where ICT projects exist in rural and underserved communities, ICT projects are under or un-utilised.

Due to this failure, Davis et al. (2014) call for a bold approach to interrogate socio-technical systems. The authors call for increasing the domains of ICT application to include a more extensive range of complex problems. Avgerou et al. (2016) argue that despite an increasing need for transformation and penetration of ICT in developing communities, the global efforts of improving the socio-economic status through the usage of ICT projects in rural and underserved communities require a renewed approach.

1.2 Rationale for the study

Previous studies show a persistent lack of rural and underserved communities' participation in ICT decision making (Mamba & Isabirye, 2015; Foko et al., 2017; Salemink, Strijker & Bosworth 2017; Kendall & Dearden 2018; Lorini & Chigona 2020). Part of the reason is the government's unilateral implementation of community ICT-based projects. Heeks and Molla (2009) attribute it to the lack of political will.

Brown and Mickelson (2019) searched for a common thread for ICT project failures. They found that even the well-planned community ICT projects intermittently experience failure because of a lack of participants' input during the program design.

Also, Chipidza and Leidner (2019) add that through the varied definition of the term 'development,' some community projects succeeded in applying one or more definitions but fail on another definition. The authors concluded that "power parity between dominant stakeholders and intended beneficiaries" (Ibid.,145) is required. Ullah (2020:126) addresses the community's existing social structures as critical to the community-based ICT projects as a whole. Participation is not merely about being present but about engineering how community stakeholders can positively impact and change the current situation.

Hevner et al.'s (2004) seminal article amplify the above argument by distinguishing behavioural science and design science paradigms in the IS discipline. Behavioural science "develops and verifies" theory while the design science "creates and evaluates IT artefacts." (Ibid.) Design science "extends the boundaries of human organisational capabilities by creating new innovative artefacts" (Hevner et al., 2004:75). Boell and Cecez-Kecmanovic (2015) argue that the behavioural science research field incorporates understanding the technical views, social views, socio-technical views, and process views. Also, Saunders et al. (2019) emphasise that socio-technical views play out in digital transformation, and digital disruptions persistently affect industries and communities. Papalambros (2015) argues that DSR integrates the general social science theories, design thinking, and socio-technical approaches to design an artefact suitable to address human and organisational capabilities. The DSR paradigm further describes existing realities and prescribes new realities that provide solutions to complex problems.

So DSR viewed as both art and science justify its usage as it creates an artefact situated in a physical context, understanding its psychological intentions, the economic implications, and social and virtual environments (Papalambros 2015). Most studies have implemented descriptive research, which develops and verifies but few or no research has been prescriptive and pragmatic, following the DSR paradigm in defining community stakeholders' participation in rural and underserved communities. The methodological limitation misses the vital operational concepts in community development.

The two independent IS disciplines, emerging in the 1990s, community informatics (CI) and enterprise architecture (EA), can address critical conceptual issues in designing, deploying, and implementing community-based ICT projects. Both CI and EA have occupied the socio-technical space of disciplines promising to enhance and advance the usage of ICT projects within their communities and organisations (De Moor, 2015; Korhonen et al., 2016; Harvey, 2017; Korhonen & Halen, 2017; Marais

& Van Biljon, 2017; Danesh, 2018; Halawi et al., 2019). This space lends itself to the imperatives of interdisciplinary integration. Repko (2011:6) defines interdisciplinary integration as "the process creatively combining ideas and knowledge from disciplinary and other sources to produce a more comprehensive understanding or cognitive advancement." Independently, CI from the rural and underserved community contextual setting and EA from the governing context can synthesize ideas, concepts, and models to produce an EA4CD framework for ushering a comprehensive solution community development.

Chapter 4 presents comprehensive contextual settings. Suffice to state that the research's justification for basing this study on Grabouw rural and underserved communities and the government contextual setting anchors is worth mentioning. The rural town of Grabouw, situated in Theewaterskloof (TWK) municipality of the Overberg district of the Western Cape province, is a mostly rural farming community. Grabouw's prowess in farming, informal settlements of people who migrated from other areas of South Africa and neighbouring countries, looking for seasonal farming jobs, settled in this rural town. During the off-season, the informal settlements dwellers face a challenging season of instability, uncertainty, hunger, and poverty. Basic services delivery challenges include water, electricity, sanitation, and sewage inundate TWK municipality with protest challenges and violence. This action underlines the critical need for meaningful contact and communication among the stakeholders, co-creating acceptable solutions for both parties. Community-based ICT projects can prepare and enable the communicative environment.

Kumar and Singh (2012) argue that the government is a critical component in establishing an administration, instituting legislation, and providing services. The government is a significant player who allocates roles to the private sector. The Western Cape Government (WCG), as a provincial government, is responsible for the overall framework and plan for developing the economy and improving service while the local municipalities provide essential services such as sanitation, electricity, and water.

The SA government provides a wide range of community services such as home affairs services, youth development programs, and social security services. The one service critical to the community's development is a one-stop service known as a multi-purpose community (MPCC or Thusong Service Centre or e-Centre). Through the WCG's program, known as the Cape Access program, approximately twenty e-Centres were established, and one of the centre was placed in Grabouw. Chapter 4 presents further details.

Despite the government's significant ICT interventions for the rural and underserved communities, e-Centres were not as successful as envisaged. Mutula and Mostert (2010) cite the challenges of poor ICT skills, financial constraints, and low telecommunication services. Also, Mpehle (2012) found a lack of motivation and lack of knowledge of legislation governing the e-Centre among the staff, sometimes political conflicts interference.

Therefore, this research rationale requires a methodological approach that includes analysis, synthesis, and aesthetics (Baskerville, Kaul and Storey 2018). In another article, Baskerville et al. (2016) call it a 'bounded creativity' which supports both creativity and development. The development of an EA4CD framework can help design, deploy, and implement community-based ICT projects to encourage community participation and significant government interventions.

1.3 Research problem statement

The critical and challenging concepts emerging from the previous research as persistent are the lack of effective and efficient participation of rural and underserved communities and the well-planned effective government interventions in co-creating a meaningful contextual environment (Auffret, 2010; Puspitasari, 2016; Çöltekin et al., 2017; Chen et al., 2018; Saint-Louis & Lapalme, 2018; Asha & Makalela, 2020). Çöltekin et al. (2017:115) suggest three considerations in dealing with 'persistent problem.' The understanding of the problem domain's structure and the interaction between the components. The consideration leads to "the systematic understanding of human factors" (Ibid.:115). Finally, the development of a set of practical steps to design possible solutions. Rural and underserved communities are critically challenged with unique persistent challenges when implementing community-based ICT projects.

Grabouw's rural and underserved communities present challenges similar to many rural and underserved communities in South Africa. They are the neighbours of a developed and rich farming community. Grabouw situates in the TWK municipality, a fruit basket of the WCG, SA, and possibly of the world. Thus, the government has a vested interest in this community to ensure that it economically supports the country.

The SA government encourages social cohesion, equitable distribution of resources, and delivery of essential services among its citizens. Better still, e-government enables efficiency, transparency, and access to government functions. The Department of Telecommunication and Postal Services (DTDT) regulates and directs ICT systems integration in SA. Through its Centre for e-Innovation (Ce-I), the

WCG and TWK provide plans and implement ICT systems according to DTDT's regulations.

This research focuses on community-based ICT projects, implemented by the government. The focus also includes implementing the Thusong Service Centre (TSC) or e-Centre, a government community-based ICT project based in Grabouw. The e-Center provides e-government services such as social security services, home affairs services, and health services to the Grabouw community and gives basic computer literacy training. Chapter 4 provides the structure and function of the e-Centre.

The methodological challenges and limitations between the community and government could not be ignored. IS as a major field of study provides EA and CI disciplines in a socio-technical space that deals with the communities and organisations. EA adds value in ICT planning to provide a better platform to strengthen and streamline the ICT activities and services throughout the province (WCG Planning EA Framework, 2020). EA further makes progress in both the private and public sectors (Lagerström et al., 2011). Concurrently, CI connects people and technology (Ponelis & Holmner, 2015). Together, these two disciplines can improve service quality between the government and the rural and underserved communities. Lagerström et al. (2011) argue that EA is making progress in both the private and public sectors. Dang and Pekkola (2017a:131) argue that the government requires an effective EA implementation that creates a methodological approach that "improve[s] the interoperability and efficiency of inter-and intra-organisational IT system." These improvements can further boost the socio-economy development of the region.

Whereas the government EA and CI provide novel ideas and practices in building sustainable relationships between people and technology (Ponelis & Holmner, 2015). Together, these two disciplines have not transcended above the ordinary to address concerns in rural and underserved communities. For example, Chuang and van Loggerenberg (2010:6) highlight non-technical challenges such as "communication, obtaining buy-in from stakeholders, ownership, the perception of the EAs and organisational politics" as reasons for poor EA strategies and implementation. Prior research argued that the EA strategic discussion, and its implementation, is not filtering down to the provinces, especially to rural communities (Saha, 2010; Foster, 2012; Mudaly et al., 2013; Lapalme et al., 2016; Nehemia-Maletzky et al., 2018). For example, in 2001, the SA government failed to formulate an ICT policy to lower data costs, increase productivity, and achieve

citizen convenience (Republic of South Africa, 2001). The SA Government Information Technology Officers Council (GITOC) formulated a government-wide EA (GWEA) to "fast track the implementation and diffusion of the e-government" (Twinomurinzi, 2012:9). This initiative is dawdling and invisible.

Rural communities lack the knowledge, skills, and capital to develop EA strategies and implement EA strategies (Moodley et al., 2012). With these constraints prevalent in the rural communities and traditional EA frameworks being complicated and challenging to implement, community-based ICT projects and rural community research requires a new approach towards developing an EA framework solution.

CI emerges as the subset within the broader ICT4D discipline, critiquing and mapping out a direction for community development support (Gurstein, 2007). CI also emerges as a better instrument directed to resolve multi-sociotechnical problem solving within the community (Stillman & Denison, 2014). Through CI, rural and underserved communities can engage better with private and public sector partners to contribute to economic, social, and cultural activities.

Chen et al. (2018:2) argue that CI lacks building "community awareness and facilitating participation." Community awareness and participation are critical ingredients to reduce the digital divide and ensure ICT use by the communities and, more crucially, community development. Usually, communities exclude themselves from participation because of a lack of knowledge and skills. The government unwittingly excludes community participation by introducing projects that they deem fit to add value to the community. Kapondera and Namusanya (2017:14) cite problems that hinder progress in government e-Centres in rural communities as (i) inadequate office operational hours that do not always meet the user requirements; (ii) shortage of technical support staff and lack of materials such as printing paper; (iii) slow Internet connection and, at times, lack of electricity; (iv) overcrowding.

Diga et al's (2013) study of ICT policy and poverty reduction in Africa laments the continued dominance of an economic focus that supports techno-determinist discourse in the implementation of ICT policies. The authors argue that this approach downplays the gravity of social factors in terms of allowing ICT projects to address the issues of poverty. Surry and Baker (2016) argue that technology influences individuals within the communities, who in turn influence the whole community. The community directs community development, which affects a myriad of economic social, human and political forces for their continued use and expansion (Ibid.).

Similarly, Walsham (2017) lists significant societal issues requiring attention to address the lack of progress in ICT projects. Some of these issues involve the neglect of women in societies; the lack of improvement in global health; the dark side of ICTs that entail internet crime, pornography and identity theft; environmental and climate changes; humanitarian crisis; as well as wars and terrorism. These challenges, according to Szostak (2017:18), need interdisciplinary creativity that is able "to draw connections among previously disparate ideas" so that community-based ICT projects can affect the communities in a meaningful manner. Bruckmeier (2018) states that interdisciplinarity provides knowledge where separate disciplines' intersecting knowledge meet.

The practical problem statement is:

> Rural and underserved community in Grabouw faces unique challenges when implementing community-based ICT projects. As a result, the community is failing to develop, deploy and implement community-based ICT projects that can empower them.

The academic problem statement is:

> Although much research has been conducted on CI and EA, there is still a lack of knowledge on the integration of the two disciplines in order to solve the ICT problems of rural and underserved communities.

1.4 Research aim, objectives and questions

1.4.1 Aim

The aim of the study explores how the EA4CD framework can integrate the tenets of CI with EA concepts to improve the development, deployment and implementation of community-based ICT projects. The proposed framework intends to open access to numerous community-based ICT projects that addresses issues of poverty, strengthening of democracy, and improving socio-economic development. EA4CD has the potential to address developmental challenges in rural and underserved communities, and can therefore contribute to improved living standards through the appropriate application of community-based ICT.

The study case anchors in Grabouw's MPCC, also known as Thusong Rural Community Centre. The location of the Grabouw Thusong Rural Community Centre is on the rural outskirts of the urban city of Cape Town. This community is in the neighbourhood of the best and prosperous farmers in SA, exporting tons of harvest internationally. The study focuses on assisting with improving the rural underserved

communities' participation and involvement in local service delivery and governance of their community.

1.4.2 Objectives

The main research objective is:

- To develop an EA4CD framework that can guide the development, deployment and implementation of the community-based ICT projects with a view of improving the living standards within the rural and underserved communities.

The research sub-objectives are as follows:

- To determine the challenges faced by rural communities when implementing ICT projects.
- To integrate the community CI principles and government EA strategies in implementing community-based ICT projects within rural and underserved communities in South Africa.
- To establish a framework where CI and EA strategies can assist in the implementation of ICT projects in rural and underserved communities.

1.4.3 Research questions

The primary research question (PRQ) is as follows:

PRQ: How can an Enterprise Architecture for Community Development (EA4CD) framework be developed to integrate EA, CI and community needs to assist with the implementation of community-based ICT projects in rural and underserved communities?

The sub-research questions (SRQs), objectives of the questions and methods used to answer the questions are shown.

SRQ 1: Why are rural and underserved communities not benefiting from CI when implementing community-based ICT projects?

SRQ 2: What is the role of government EA in implementing community-based ICT projects?

SRQ 3: How can EA and CI be integrated to address community needs in the rural and underserved communities?

1.5 Overview of the theoretical framework

The theoretical framework and the participatory development theory (PDT) (section 3.2) underpin this study (Puri & Sahay, 2007). PDT provides an analysis of a multilevel complex yet dynamic process for defining participatory agenda and capabilities of the participants. Furthermore, PDT describes the institutional role of participation and social structures. Sustainability and scaling up can be harnessed in developmental efforts and extended in scope and coverage. Sustainability concerns the long-term viability of projects, including the maintenance of assets created after external support is withdrawn. This section is discussed further in Chapter Three.

1.6 Research methodological considerations

IS researchers' philosophical assumptions form the basis of what direction or approach to select, which then leads to setting assumptions that inform researchers of the nature of reality or the world-view that they operate in.

There is a need to highlight the central principle of producing prescriptive knowledge rather than descriptive knowledge. This descriptive knowledge provides an understanding of the 'as is' state, which provides the basis for the credibility of this study. The prescriptive knowledge dominating this research develops and formalises a strategy, model or framework that integrates the relationship between the academics, practitioners, the community, CI needs, EA concepts and community-based ICT projects. Saat et al. (2010:14) argue that prescriptive knowledge is "situation-specific or at least [an] adaptable solution instead of one-size-fits-all" artefact. Design science research (DSR) fulfils this prescriptive need.

Besides, the interdisciplinary, qualitative interpretive study – approached as an abductive explorative study in DSR using various research methods – seeks ways to respond to the research questions. Peirce (1960:469) defines abduction in an interpretive case study as "the gateway to any scientific investigation which examines some factors to attain the most probable 'surprising fact'". Åsvoll (2014) states that when abduction, the first scientific investigation stage, is realised, then the probable fact can be deductively examined, evaluating the truthfulness of the generated facts (theory testing), and then inductively justified with empirical data. However, the overall research applies the abductive part in a cross-sectional time zone. The deductive and the inductive parts are for further studies.

In this research, DSR builds and proposes an innovative EA4CD framework for developing community-based ICT projects in rural and underserved communities. This framework is relevant for identifying opportunities applicable to socio-economic development.

1.6.1 Research paradigm and philosophy

IS researchers have always carefully considered the research paradigm from which to launch their research. The researcher elected the interdisciplinary, interpretive qualitative approach to the DSR paradigm using various research methods to respond to the research questions.

Figure 1.1 demonstrates the DSR research strategy used in this study with three sub-cycles to develop the EA4CD framework, which can assist in the implementation of community-based ICT projects. Kotzé et al. (2015) propose a similar research strategy for doctoral students who seek to find solutions for complex design problems. The main cycle addresses the primary research question, while the three sub-cycles address the three sub-research questions. The DSR research strategy is further expounded in Chapter Five.

Philosophical assumptions such as the ontological, epistemological, methodological and axiological assumptions informing this approach were summarily explained in this section but expounded in detail in Chapter Five.

The ontological stance adopted for this study is what Vaishnavi and Kuechler (2004:19) call the “multiple, contextually situated socio-technologically alternatives world-states”. Aljafari and Khazanchi (2013:3753) posit the ontological stance as the “multiple world states where reality is socio-technologically constructed”. The study constructs an artefact, EA4CD, of which its behaviour is as the result of the contextual interactions from which it exists. This ontology embraces the view that social reality exists due to human experiences, and it includes people’s knowledge, views, interpretations and experiences.

Epistemology seeks to respond to the questions of cognition and the object of cognition, as Becker and Niehaves (2007) argue, responding to questions whether reality will ever be understood (Knight, 2010). The epistemological stance adopted for this study based on DSR is what Vaishnavi and Kuechler (2015:25) call, “knowing through making” where reality is tied to practice.

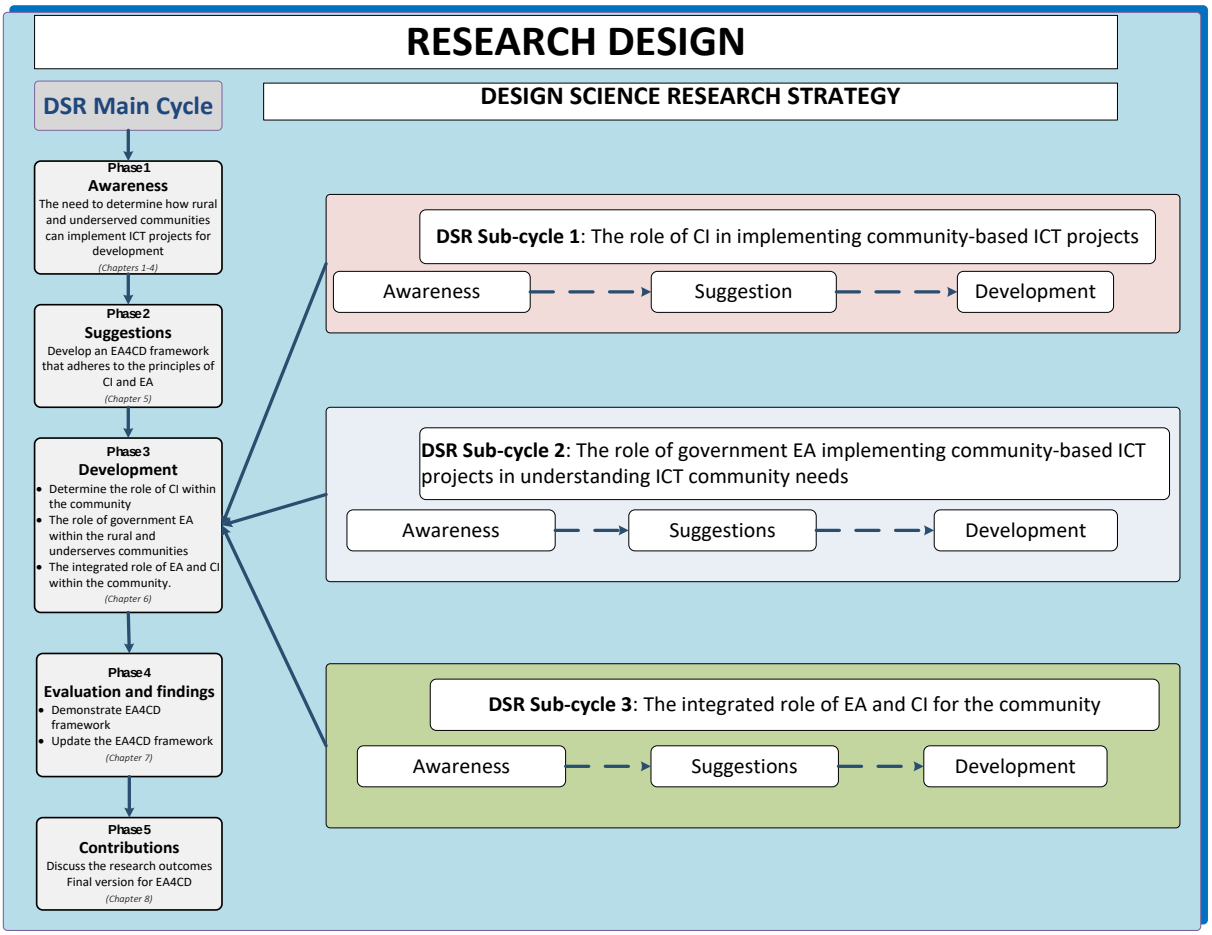

Figure 1.1: Design science research (DSR) as a research strategy

The epistemological stance seeks to explain how the community participates in constructing reality. Furthermore, the study encompasses research methodological assumptions that gather, validate, and analyse the data, and then creates the argumentation. The work plan of this research, which is discussed in later sections, is used to describe, explain or predict the framework being studied.

Axiological assumption considers the role of values, intuition and bias within the research (Cresswell et al., 2013). Researchers declare their value judgments from the onset, whether these are value-laden or value-free (Burrell & Morgan, 1979). Cultural experiences and upbringing regulate value-laden judgements, whereas value-free judgments are independent of data, maintaining an objective stance, Dudovskiy (2018) further argues that the value-bound researcher holds a subjective stance that cannot be detached from the research.

In this research, the researcher considers value-free judgments, while value-bound judgments are not excluded. This stance is necessary for information gathered from the field, as it permits interviewed freedom of expression and articulation. The

challenges of rural underserved communities in community-based developments are better understood when biases and prejudices are set aside.

The fundamental question in rhetorical assumptions is, “What is the language of research?” This question leads to the use of language as the art of persuasion. The type of study, whether it is ethnographic, grounded theory or case study, lends itself to a particular language and structure of the research report (Creswell, 2007). No matter what structure has been chosen, the qualitative researcher must report reality through the eyes of the research, without exaggerating or minimising the issues at hand.

1.6.2 Research approach

Qualitative research aims for a deep understanding of an organisation or an event. It seeks to provide structure, order and large patterns (Merriam, 2002). It is usually associated with a social constructivist paradigm that emphasises the socially constructed nature of reality. In qualitative research, observation and analysis guide the research. Quantitative research, on the other hand, classifies, counts and even constructs a sophisticated statistical model that explains a phenomenon, and is usually associated with the positivist/post-positivist paradigm (Merriam, 2002).

This research is qualitative in nature because of the following reasons:

i) It is essential to establish synergies among respondents to create acceptable ideas.
ii) The dynamic nature of the interview or group discussion process engages respondents more actively than is possible in a more structured survey.
iii) The opportunity to observe, record and interpret non-verbal communication (i.e., body language, voice intonation) as part of a respondent’s feedback is valuable during interviews or discussions, and during analysis.
iv) There is the opportunity to engage respondents in ‘play’, such as projective techniques and exercises, overcoming the self-consciousness that may inhibit spontaneous reactions and comments.

1.6.3 Sampling strategy

A purposive, snowball sampling strategy has been adopted for this study. The purposive sampling applied in this qualitative research assisted in identifying and selecting appropriate information-rich cases related to the implementation of community-based ICT projects in Grabouw. Snowball and convenience sampling strategy followed the purposive sampling. The aim was to recruit further and future subjects from among the participants’ acquaintances. Sample size depended on the

researcher's discretion when interviews, at some point, started to yield no additional or new information.

1.6.4 Data collection strategy

Practitioners and experts in the IS field and community provided valuable information in identifying relevant problems. Explorative semi-structured interviews, documentation and workshops provided qualitative data and useful insights. Data collection was achieved through interviews or group discussion processes, engaging respondents more actively than is possible in a more structured survey.

1.6.5 Data analysis

The researcher transcribed the recorded interviews. The transcriptions were uploaded on ATLAS.ti for coding, categorising and analysing data into themes using abductive grounded theory principles (Rahmani & Leifels, 2018). This discussion is further explored in Chapter Four.

1.6.6 Findings

The primary finding of this research that there exists a dire need to ensure that the rural and underserved communities participate in the development, deployment, and implementation of community-based ICT projects that promote community development.

1.6.7 Conclusion

The proposed EA4CD design framework is a possible solution for integrating the rural and underserved communities' views of community development with the government's viewpoint.

1.6.8 Recommendations

The EA4CD framework requires formative and summative evaluative assessment to integrate the EA and CI disciples further for the benefit of the rural and underserved communities. The government should lead this evaluative process.

The study needs additional time and inventions for an interdisciplinary approach from researchers of different fields. The integration of disciplines needs to be encouraged and applauded to advance research relevance. Walsham (2017:35) argues that, "individuals [researchers] bring their disciplinary background to the table that they have something different to offer". Researchers can learn from one another.

1.6.9 Generalisation

Lee and Baskerville (2003) argue that generalisation in IS research is necessary to manage and solve problems experienced in society. Furthermore, Rossi et al. (2012) posit that it is essential for DSR to generalise so as to avoid reducing the research process to a mere building of artefacts. Rossi et al. (2012) suggest four levels of generalisation in DSR:

i) **A generalisation of the problem instance:** The original problem is defined as an instance in a class of problems. The Grabouw case is a microcosm of a class of problems of rural and underserved communities shown in the problem statement (section 1.3). The rural and underserved community of Grabouw has a prosperous and rich farming community. The poor, underserved communities are living at the 'doorsteps' of prosperity; a similar condition duplicated in the rest of the underserved communities of South Africa.

ii) **A generalisation of the solution instance:** The proposed solution, the EA4CD framework as an artefact, is an instance of a class of solutions. The EA4CD framework allows possibilities of duplicating the artefact, and its principles are based on other contexts.

iii) **Emerging design knowledge in the form of design principles:** The solution instance is captured as a design principle.

iv) **Feedback to design theory:** This level is feedback to design, determining the range of generalisability. The feedback may be to create mid-level design theories and refine contributing theories.

Chapter Five provides a more detailed discussion on the generalisation of this research and ethical issues.

1.7 Contribution of the research

Previous research in ICT4D has been dominated by studies on the effectiveness or efficiency of ICT projects on organisations, teams or individuals (Chapter Two). The results of the published research indicate some deficiency. There is a need, therefore, to push the boundaries further by researching the utility of ICT projects, characteristics of the community, its work systems, its people, and its development and implementation methodologies together to determine the extent to which the purpose is achieved.

Hirschheim and Klein (2010), in their short history of IS, claim that this field (IS) is highly diversified and pluralistic, and that IS as the body of knowledge is required to converge the different areas of research, stimulating intellectually rigorous and

flexible IS research. The integration of CI and EA is a step towards contributing to that body of knowledge. The use of DSR demonstrates the pragmatic paradigm that calls for the creation of innovative artefacts to solve the real world by explaining the role of the IT artefact. This research is significant to the Grabouw community in addressing the difficulty experienced in building the excellent infrastructure, creating a developmental and innovative environment, and utilising the e-commerce opportunities that the WCG provides to improve the community's socio-political-economic situation.

1.7.1 Theoretical contribution

The theoretical contribution of this research lies in the growing field of IS within the interdisciplinary studies, especially for the emerging CI and EA. The integration of CI and EA contributes to the interdisciplinary studies. Further, the research has drawn on DSR as a research methodology, contributing to scholarly literature by demonstrating how the prescriptive knowledge of constructing an artefact, EA4CD, was applied. Both theoretical and empirical findings contribute to the construction of EA4CD in building rural and underserved communities.

Theoretical contributions are further discussed in section 8.3.1.

1.7.2 Methodological contribution

The methodological contribution of this study has been the application of pragmatic phased DSR methodology, interspersed with abductive thematic analysis methods (section 5.11) and the evaluation processes (section 5.12) in building and evaluating the designed artefact, EA4CD.

The researcher's gained practical experience of applying theoretical and conceptual concepts provided invaluable methodological contribution. The construction of the research design, use of research methods, analysis of the results gave the researcher an invaluable to experience.

The methodological contribution is further discussed in section 8.3.2.

1.7.3 Practical contribution

The practical contribution of this research is the insights into the unique challenges faced by the rural and underserved community in the Grabouw case. The case reveals that for the effective implementation of community-based ICT projects, participation is critical. Participation can increase the social integration, a necessary community ingredient to empower and improve the economic, political and social status of living by exposing them to better markets (section 8.3.3).

1.8 Ethical considerations

The result of DSR is the creation of effective, efficient and innovative artefacts and knowledge that have the potential to change how communities live and invariably make the world a better place to live in (Iivari, 2007; Myers & Venable, 2014). Myers and Venable (2014) suggest six ethical considerations that were considered in this study (section 5.13):

i) **The public interest**: The Grabouw community's exposure to ICT usage through the operation of the Thusong e-Centre creates public interest in community-based ICT projects. It creates expectations and desires for improved ICT innovative solutions. The researcher carefully managed these expectations by not raising false hopes that the study would deliver fast and innovative ICT solutions.

ii) **Informed consent:** All participants involved in this study were informed of their rights to participate. Participation was voluntary and even if consent was granted, the participant had a right to withdraw from participating. The researcher obtained ethical clearance from the university's CPUT ethics committee (Appendix F).

iii) **Privacy:** Participants' privacy included anonymity, confidentiality and protection. The benefits of guaranteed privacy resulted in truthful responses required for this study.

iv) **Honesty and accuracy:** The researcher carefully navigated interviews without offending or irritating participants. Truthful and accurate responses need not be overstated or understated responses.

v) **Property:** The researcher explained the process of storing and analysis, as well as what would eventually happen to the data collected. Data verification procedures were also explained.

vi) **Quality of the artefact:** The research endeavoured building a high-quality artefact that will make a difference in people's lives.

Given all the necessary clearance requirements, Myers and Venable (2014) express doubt that any of the dominating social sciences in the IS field can be value-free. According to Iivari (2007), it is even true that DSR can state that it is ethically value free. Despite all these claims, the researcher has complied with the ethical requirements.

1.9 Research assumptions

Orlikowski and Baroudi (1991:4) explicate that research assumptions are based on three beliefs: (i) beliefs about physical and social reality; (ii) beliefs about knowledge; and (iii) beliefs about the relationship between knowledge and the

empirical world. Due to the qualitative nature of the study, several research assumptions can be made. Firstly, the community stakeholders are assumed to be capable of instituting more inclusive decisions, encouraging ownership of developmental processes. Secondly, EA is assumed as a term used within a structure or an organisation whose elements or components fulfil specific criteria.

On the other hand, CI research is based on collaboration between the community and the researcher. Stoecker (2005:33) alludes that "one of the best ways to makes sure that the research will be useful, and that the research methods will fit the culture of the group or community, is for the people affected by the research to guide it." Concepts or words such as "partnership" and "collaboration" are assumed in CI research. Further, CI is neither synonymous with community ICT projects nor ICT4D. Community ICT projects and ICT4D contribute to community development. However, CI design and development focus on the role of ICT in addressing community needs rather than addressing what technology can do but if ICT initiatives can support, sustain and empower communities

Another contributing factor to community informatics' somewhat singular trajectory has been the assumption that ICT practitioners are synonymous with community practitioners. While some ICT practitioners' activities in the community contribute to community development, this is not always the case. Public-access initiatives often focus on developing computer skills in individuals rather than supporting community development goals through contextualised community learning courses (Day, 2011).

Finally, voluntary participation assumes that the participants would respond precisely and truthfully to the interview questions based on their personal experiences and respond honestly and to the best of their abilities.

The philosophical assumptions research are discussed in greater detail in Chapter 5 (section 5.2).

1.10 Scope and delineation of the study

The number of participants in this research determined the scope of the research. The interviews, which determined the number of participants, were considered enough when the participants gave more or less the same responses. The Grabouw community represented the unit of observation while the community-based ICTs represented the unit of analysis.

The definition of the concept of a community is broad. Communities can be either (locus) geographic communities or virtual communities. In this study, the community

was delineated to mean people living in the same geographic area in the neighbourhood of towns or cities, excluding virtual communities.

1.11 Summary

Chapter One introduced the dire need for community-based ICT projects able to assist the rural and underserved communities in improving their living conditions. The UN is working hard to eliminate poverty among large communities living in rural and underserved communities.

The practical problem statement is as follows: Rural and underserved communities face unique challenges when implementing community-based ICT projects. As a result, these communities are failing to implement community-based ICT projects that can empower them. The focus of the academic problem is on interdisciplinarity, namely, EA and CI, to provide a solution to ICT problems in rural and underserved communities.

The aim of the study is exploring and understanding EA and CI to propose an Enterprise Architecture for Community Development (EA4CD) framework that integrates the tenets of CI with EA concepts. The objective is to propose an EA4CD framework that can guide the development, deployment and implementation of the community-based ICT projects with a view of improving the living standards within the rural and underserved communities.

The DSR paradigm provides a five-step phase of building and evaluating the EA4CD framework as a design product. For the data collection, semi-structured interviews and document analysis were adopted, and for the data analysis, methods such thematic analysis and abductive grounded theory were applied.

The findings demonstrate a need for the participation of rural and underserved communities in the implementation of community-based ICT projects.

As outcome, a preliminary EA4CD framework integrating EA and CI is proposed to implement community-based ICT projects that address the triple challenge of poverty, inequality and unemployment.

Contributions of the research focus on three areas. Firstly, the theoretical contribution concentrates on interdisciplinary studies in the field of IS. Secondly, the methodological contribution is demonstrated in the different research methods used to solve the problem at hand. Thirdly, the practical contribution is the application of the EA4CD framework to empower the rural and underserved communities.

1.12 Structure of the thesis

Chapter One provides a synopsis of the research, indicating how rural and underserved communities are not fully benefiting from ICT initiatives despite the exponential growth and usage of ICTs in the world. The research problem demonstrates the unique challenges that rural and underserved communities experience. In the IS field, CI and EA independently holds the promise of ICT usage and implementation. The research therefore proposes the possible integration of CI and EA to build an EA4CD framework to address the lack of ICT progress within these communities. Research questions were formulated to probe for solutions to the problem.

Chapter Two presents the systematic literature review (SLR), explaining the role of EA and CI in community-based development of ICT projects in rural and underserved communities. The research gaps that emerged indicate the shortcoming of research in terms of the implementation of community-based ICT projects in rural and underserved communities.

Chapter Three presents the participatory development theory (PDT) that guides the entire research process. PDT explains and predicts behaviour and relationships among social entities. The researcher presents other related IS social theories to highlight why PDT has been selected as the preferred theoretical framework to underpin theory used as a lens in this research.

Chapter Four presents Grabouw in the Western Cape, SA, as more or less the microcosm of a broader situation of the rural and underserved community. The chapter defines the landscape, socio-economic activities, governance, and ICT activities, further explaining why Grabouw was qualified as a case (field) study. It is in this rural and underserved setting where the empirical study took place with the purpose of understanding why rural and underserved communities continue to lag in implementing community-based ICT projects.

In Chapter Five, the researcher explains the philosophical and research paradigm standpoint, thereby outlining how the research design and process unfolded. The DSR emerged as the preferred research paradigm to respond to community-based ICT challenges. The researcher presents a detailed research process proposed by Vaishnavi and Kuechler (2015). Furthermore, the grounded abductive method, as proposed by Rahmani and Leifels (2018), was used to analyse data.

Chapter Six presents the empirical study where the research findings are discussed.

Chapter Seven presents the preliminary evaluation of the EA4CD framework to ascertain its validity, fitness and utility using Venable et al.'s (2016) DSR evaluation process.

Chapter Eight summarises the notable findings of the research. The researcher presents the contributions, which include a review of the theoretical, methodological and practical relevance.

Finally, Chapter Nine reflects on the researcher's perceptions and feelings during the doctoral journey.

Figure 1.2 below presents a diagram of the logical flow of the thesis.

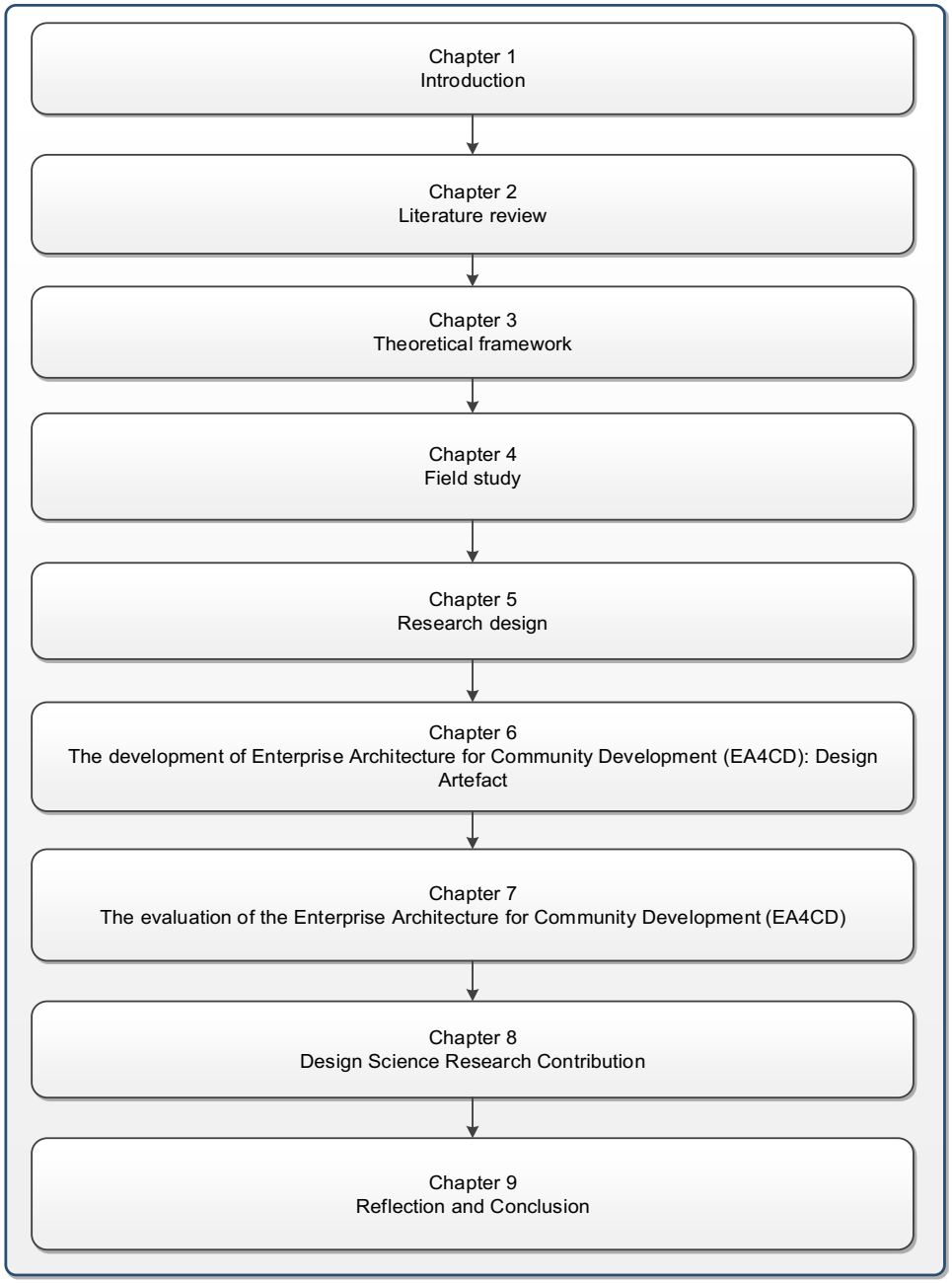

Figure 1.2: Thesis layout

In the next chapter (Two), the systematic literature review is discussed.

CHAPTER TWO: THE SYSTEMATIC LITERATURE REVIEW

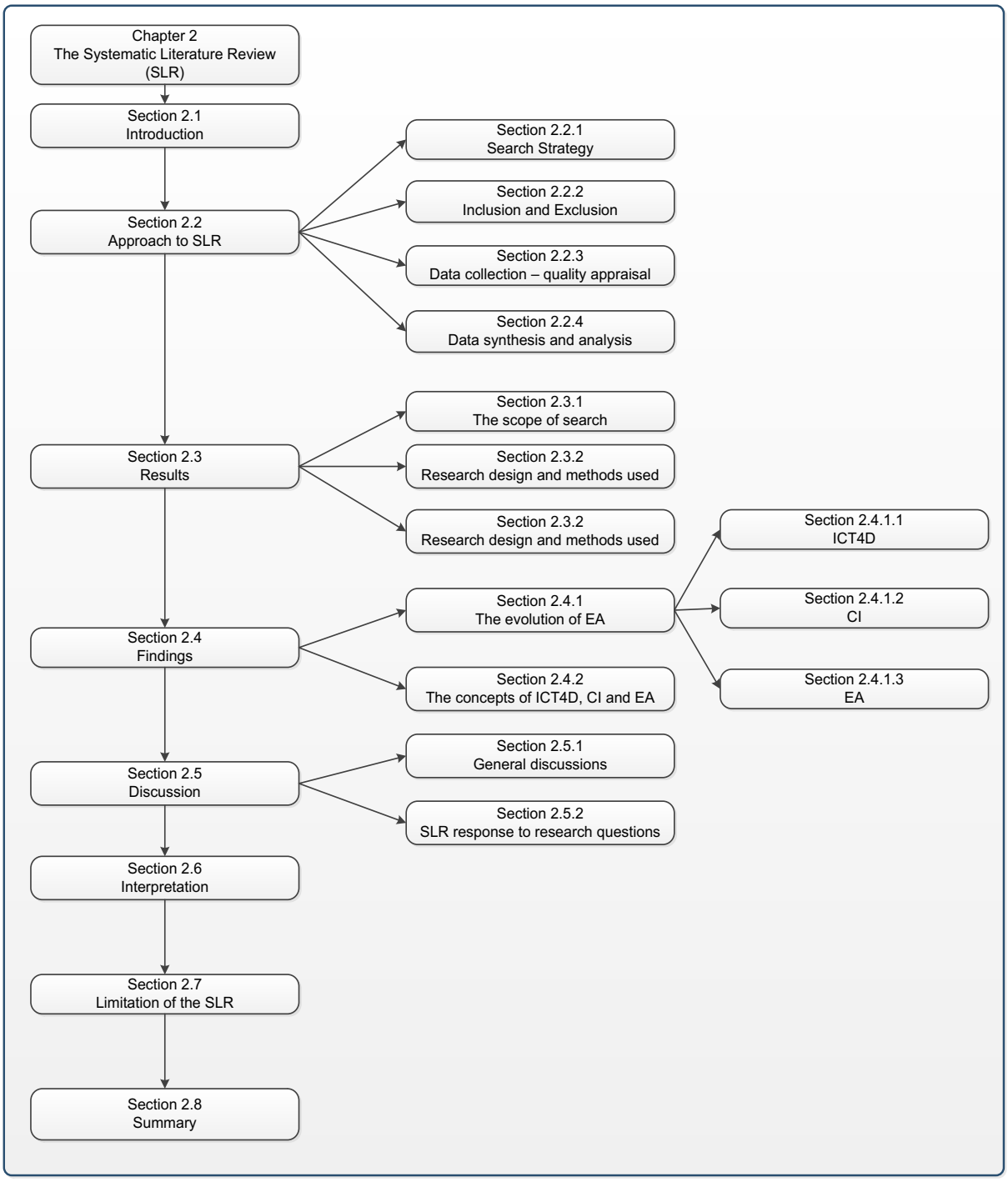

Figure 2.1: Chapter Two flow

2.1 Introduction

In the previous chapter, it was shown that rural underserved communities are not benefiting from the ICT infrastructures available to them, despite the proliferation of digital technologies for development and transformation. Since the 1980s, ICT for the ICT4D discipline focused on the diffusion of artefacts, infrastructure building and the implementation of ICT services for development in “less materially advantaged

members of societies" (Walsham, 2017:18). In the 1990s, CI emerged as a discipline that sought to empower communities in economic development, social justice and political empowerment. Both CI and ICT4D affected rural and underserved communities. Gurstein's (2007:63) definition of the CI discipline is that CI is an "implicit critique of the conventional approaches to ICT4D". According to Carroll and Rosson (2013), visibility of the community actors, the creation of community information infrastructure, the role of place-based identity and activities within the community, and the effectiveness of participatory relationships set CI apart from the ICT4D discipline. This moves CI beyond mere usability and design into participatory design.

While CI focuses on communities, EA focuses on governments and organisations that provide a holistic integration of the business view, information view and technological view. This ensures an integrated service to the communities and to clients. EA is a means of transforming and sustaining the mission of the enterprise throughout the lifespan of an enterprise (Hjort-Madsen & Pries-Heje, 2009). Arguably, EA can play a critical role in bringing together government services and the community through using CI to improve community-based development in rural and underserved communities.

A dearth of literature exists that conceptualises the role of EA in community-based developmental projects in rural and underserved communities. The scarcity of research demonstrates the lack of a conceptual EA structure, which can be exploited with a view of improving community-based developmental projects.

In this chapter, the researcher aims to document the results of a systematic literature review (SLR) undertaken to identify and appraise existing outcomes of the literature on the role of EA in community-based development projects in rural and underserved communities. The researcher establishes how the existing CI literature depicts the status within rural and underserved communities. Furthermore, it explains how EA transformation within the private sector or organisations can transform community-based developmental projects. Finally, this study explores research gaps that exist in the literature.

The following **research questions** (section 1.5) guided the SLR:

PRQ: How can an Enterprise Architecture for Community Development (EA4CD) framework be developed to integrate EA, CI and community needs to assist with the implementation of community-based ICT projects in rural and underserved communities?

SRQ 1: Why are rural and underserved communities not benefiting from CI when implementing community-based ICT projects?

SRQ 2: What is the role of government EA in implementing community-based ICT projects?

SRQ 3: How can EA and CI be integrated to address community needs in the rural and underserved communities?

Avgerou (2000) argues that the strength of any discipline lies in its ability to respond to a large variety of issues. Styron Jr. (2013) calls for different disciplines to seek common ground even if insights disagree. The interdisciplinary theoretical stance underpins this SLR. Walsham (2017) describes interdisciplinarity as a way forward to demolish the '*silo'* mentality that IS researchers often find themselves in. The statements of Avgerou (2000), Styron Jr (2013) and Walsham (2017) are of importance for this study as the integration of CI and EA attempts to bridge the silo effect of these disciplines.

The purpose of this SLR is to provide a critical evaluation of evidence on the implementation of community-based ICT projects in rural and underserved communities.

2.2 Approach to the systematic literature review

Okoli (2015) presents a comprehensive eight-step qualitative SLR approach. The author cautions that these steps should not be followed mechanically, but applied with logic and understanding. The approach truncates Okoli's (2015) eight steps to an abridged version of four steps entailing the following: (i) search strategy; (ii) inclusion and exclusion criteria; (iii) quality appraisal; and (iv) data synthesis and analysis (Figure 2.2).

2.2.1 Search strategy

The search strategy for this research study focused on published peer-reviewed journals, conference papers, editor reviews and book chapters. The search also targeted the following online databases: ACM Digital online, Emerald, Google Scholar, IEEE Online, JSTOR, Scopus, ScienceDirect, SpringerLink, Taylor and Francis, and Web Online. The identified citations of the searched articles in the first round provided more clues to other relevant articles. Further searches were conducted using the sources cited in articles. More articles were sourced from the institutional databases. In-depth reviews were undertaken on the full text of a set of articles.

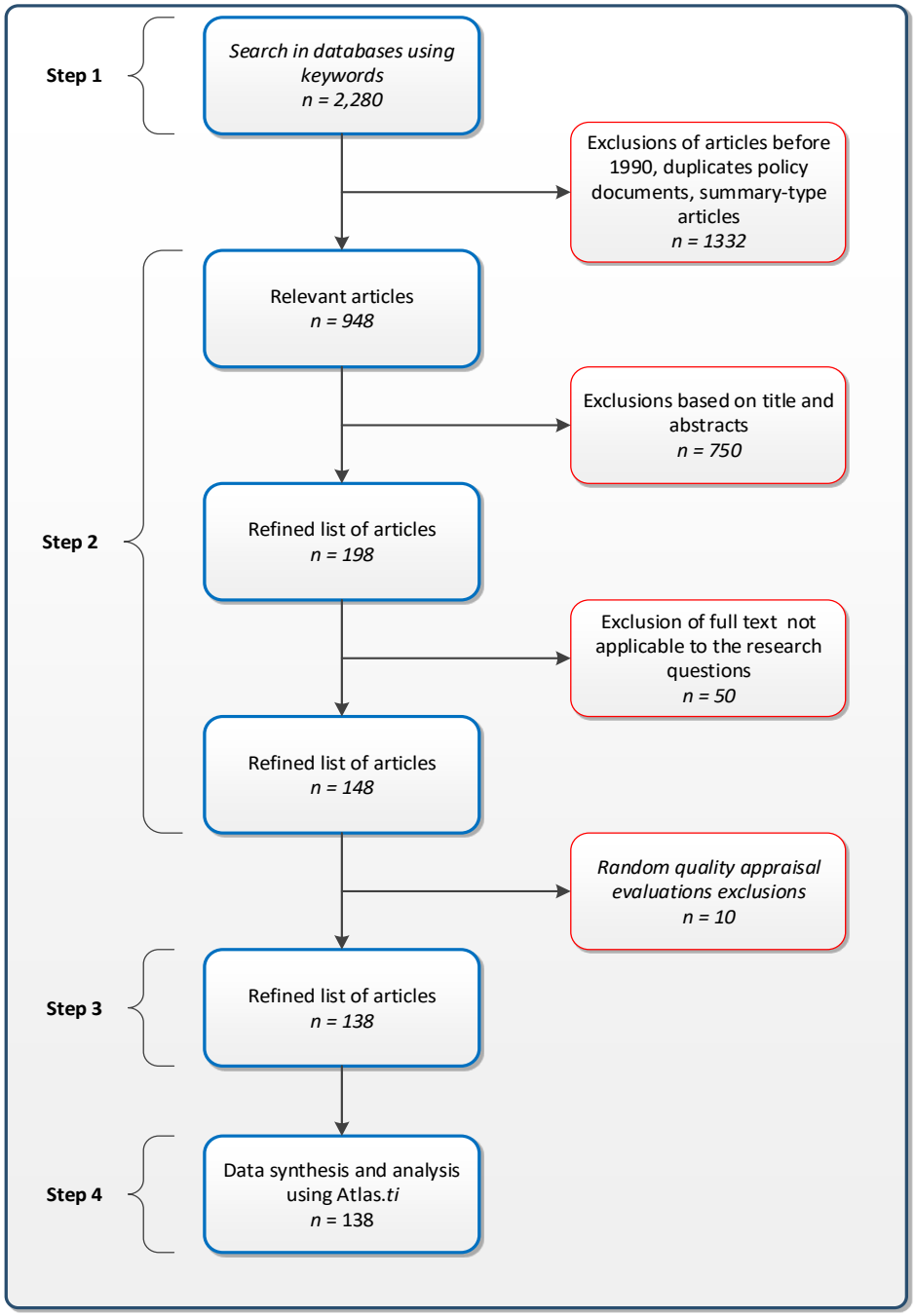

Figure 2.2: The literature selection process

2.2.2 Inclusion and exclusion criteria

2.2.2.1 Inclusions

The search included articles published in English. It also included studies referring to ICT4D, CI and EA in the titles and abstracts. Search key inclusion criteria included government enterprise architecture, community informatics, information and communications technology for the development or ICT4D, integration, interdisciplinarity and rural underserved communities (Table 2.1). The strategy provided literature that presented ICT4D, CI and EA after 1990 because research on EA, CI started around that time. The search included articles based on villages,

underserved townships and poverty-stricken farms. This period is significant because ICT4D, CI and EA emerged as disciplines during this time. The initial search strategy yielded 2,280 articles (Step 1, Figure 2.2).

Table 2.1 Search terms and keywords

Concepts	Search String
Concept 1	("Community Informatics" OR CI) AND ("Enterprise Architecture" OR EA) AND "Rural*" AND ("Participatory Development Theory" OR "Participatory theory")
Concept 2	(History OR Origins) AND ("Community Informatics" OR CI) AND ("Participatory Development Theory" OR "Participatory theory")
Concept 3	(Role OR Benefit?) AND ("Community Informatics" OR CI) AND Rural* AND ("Participatory Development Theory" OR "Participatory theory")
Concept 4	(Challenge? OR Benefit?) AND ("Community Informatics" OR CI) AND Rural*
Concept 5	(History OR Origins) AND ("Enterprise Architecture" OR EA OR ("Enterprise Architecture Management" OR EAM OR "Enterprise Information System" OR EIS) AND (Government OR e-Government)
Concept 6	(Role OR Benefit?) AND ("Enterprise Architecture" OR EA) AND Rural*
Concept 7	(Challenge? OR Benefit?) AND ("Enterprise Architecture" OR EA) AND Rural*
Concept 8	("Community Informatics" OR CI) AND ((Information Communication Technology") OR ICT) AND Rural*
Concept 9	("Community Informatics" OR CI) AND ((Information Communication Technology for Development") OR ICT4D) AND Rural*
Concept 10	("Enterprise Architecture" OR EA) OR e-Government AND Rural*

2.2.2.2 Exclusions

The researcher excluded duplicate citations across databases. Commentaries, policy briefs and summary-type articles failing to meet the search criteria were excluded. Application of the exclusion criteria reduced articles from 2,280 to 948. Some articles were excluded by considering only abstracts, bringing down the number from 948 to 198 articles. Furthermore, discarding full-text articles not responding to the research questions brought down the number of articles by 50 (n=50) to 148 (n=148) articles (Step 2, Figure 2.2).

2.2.3 Quality appraisal

The objectives of the SLR were to investigate the possible integration of CI and EA into rural and underserved communities, and to determine any research gaps that may exist in the surveyed literature. The collection of papers were subjected to Hawker et al.'s (2002) three-step process for quality appraisal review of disparate data (Appendix O). Hawker et al.'s (2002) tried and tested process was deemed suitable for this quality appraisal as it is designed to assess studies covering a wide range of research paradigms. The process entails: (i) an assessment of relevance; (ii) data extraction; (iii) scoring for methodological rigour.

The assessment of relevance: During this stage, each article was either accepted or rejected (Appendix O.1). Four further selection criteria were applied to accepted

articles (Hawker et al., 2002:1290), namely: (i) relevance to the research questions; (ii) context of the material; (iii) source of the data; and (iv) the type of study.

Data extraction: The Appendix O.2 form provided details of the article under review. Primarily in this step, it was determined how each article responded to the research questions. Three articles failed the review.

Scoring for methodological rigour: Appendix O.3 and Appendix O.3.1 presents the guide used to evaluate the following criteria: (i) abstract and title; (ii) introduction and aims; (iii) methods and data; (iv) sampling; (v) data analysis; (vi) ethics and bias; (vii) results; (viii) transferability or generalisability; and (ix) implications. Hawker et al. (2002) posit that this is not a simple procedure, especially when articles do not provide clarity on what methodology was applied. Despite these difficulties, the researcher was able to apply the process of reviewing the methodological rigour. Seven articles were further excluded, bringing down the final tally to 138 articles (Step 3, Figure 2.2).

2.2.4 Data synthesis and analysis

The data synthesis of the 138 articles was conducted interpretively. Lewis (2016:4) explains the purpose of the interpretive approach in developing concepts that lead to the development of categories, which, in turn, lead to the specification of theories. The 138 extracted articles followed a rigorous process by the researcher of reading, re-reading and concluding. The qualitative data analysis software tool, ATLAS.ti facilitated the interpretive process of finding emerging concepts and themes. The 138 documents extracted from the literature were uploaded to ATLAS.ti as Primary Documents (P-Doc) (Figure 2.3). After uploading, three stages of analysis followed.

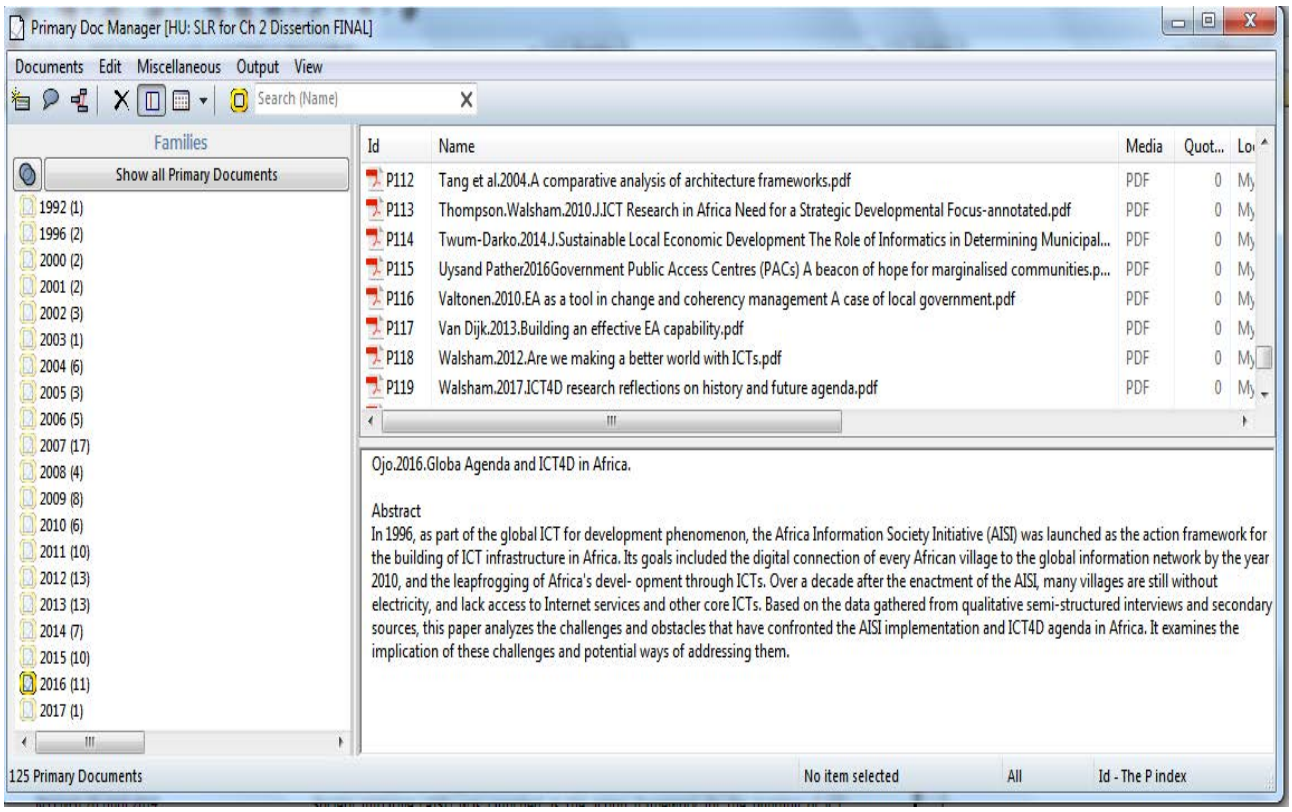

Figure 2.3: Primary documents (P-Docs) in ATLAS.ti

i) The first coding stage

The first stage coded small segments of data into descriptive codes. Phrases, sentences and paragraphs of text that formed a coherent idea were defined as open codes or *in-vivo* codes (Figure 2.4). Open codes occurred when sentences, phrases or paragraphs were labelled as codes. *In-vivo* codes are sections of highlighted text stating that the first stage codes can represent the theoretical concepts or practical or descriptive or ideas that emerged from the articles. The codes are linked to quotations in the articles.

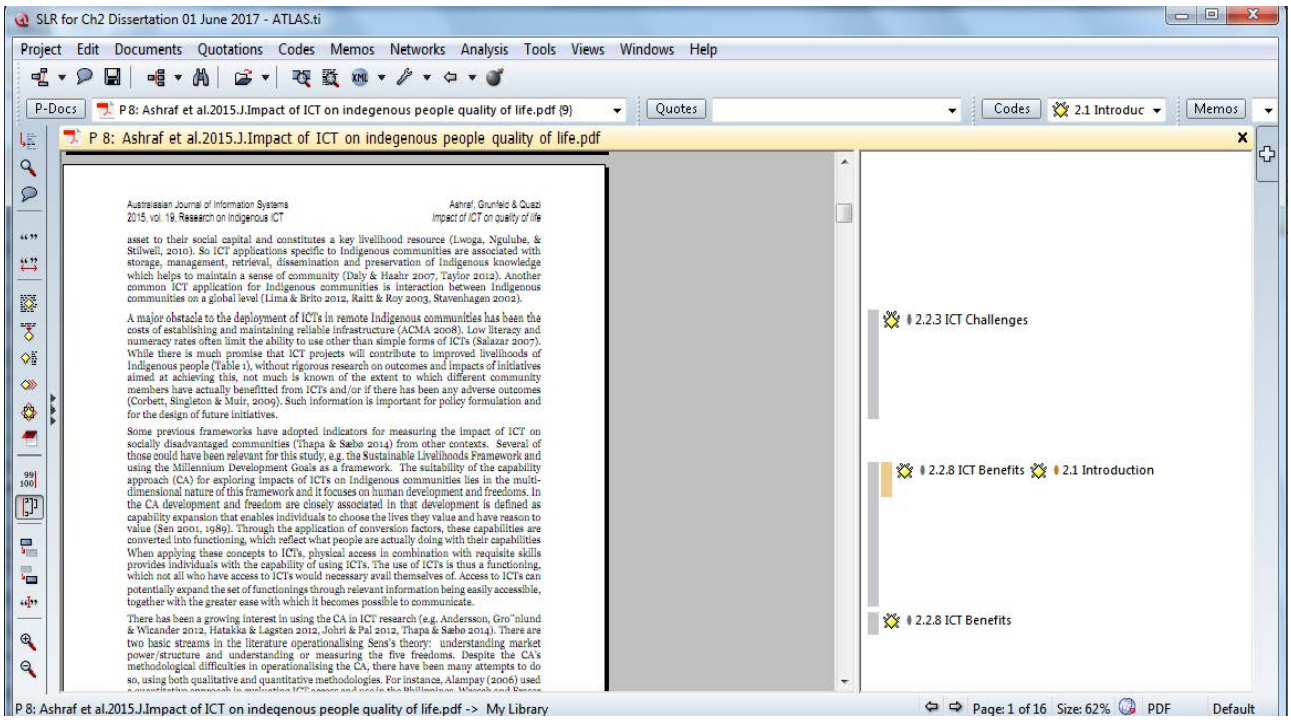

Figure 2.4: Coded PDF document in ATLAS.ti

ii) The second coding stage or axial coding

During this stage, similar codes were grouped to express higher-order categories or themes. Lewis (2016) suggests that the first-order and the second-order constructs should guide the formulation of high-order categories. First-order constructs refer to the understanding that researchers have about the subject. The second-order constructs refer to society's perspective about the issues.

iii) The third coding stage or selective coding

The third coding stage, known as selective coding, was visited and revisited to build concepts and themes, keeping in mind the research objectives of the study (Figure 2.5). ATLAS.ti provided the platform used to make chains of multiple codes and linking of quotations to create meaningful networks of themes. Codes were moved to various positions of the network and were, at times, added or discarded; permutations were tried until a reasonable explanation of a theme began to emerge. In the final analysis, the relationship between the codes began to formulate concepts, themes and patterns.

The emerging themes are presented in sub-sections 2.3 and 2.4, while the SLR findings obtained from the coding process are presented in sub-section 2.4.

Tables 2.1 and 2.2 list the codes of the first code stage as well as the resultant second stage coding (also known as axial coding), and the selective coding. Similar codes were merged. Little used or irrelevant codes were discarded.

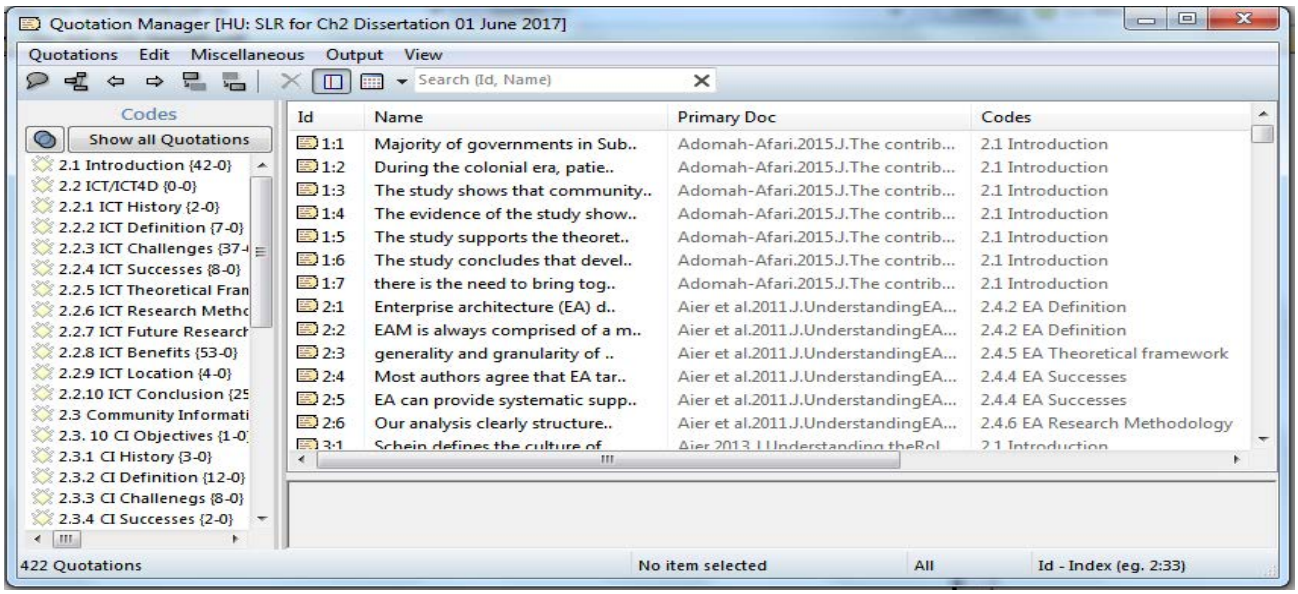

Figure 2.5: Coded quotations in ATLAS.ti

Table 2.2: Codes, categories and themes on CI from the reviewed literature

Codes	Categories (Axial Coding)	Themes (Selective Coding)
Definition of IT Definition of ICT Definition of ICT4D Evolution of 4IR	The historical analysis of CI	Role of CI
Public access E-participation Socio-economic development	CI benefits	
Digital divide Lack of ICT resources Government dominance Lack of trust Lack of confidence	CI challenges	
Community values Physical space	Community concepts	Community within CI
Human capital Social reforms Financial ability Environment awareness Cultural awareness Activism	Community development	
Anthropology Sociology Computer scientists Information systems management Philosophy Social theory	Multi- and interdisciplinarity	

Codes	Categories (Axial Coding)	Themes (Selective Coding)
Networks Hardware Software	ICT infrastructure	Access
Types of ICT Service providers	Providers	
Small businesses Big businesses Township economy	Economic development	Sustainability
Housing Roads Schools Sanitation	Environmental development	
Research Practice	CI components	

Table 2.3: Codes, categories and themes on EA from the reviewed literature

Codes	Categories (Axial Coding)	Themes (Selective Coding)
Scope of EA Universal definition Original EA definition Components of EA	Analysis of EA	The descriptive analysis of EA
Business growth Clear vision Good strategy Organisational alignment Shared information Optimised IT resources Managed cost	EA benefits	
Lack of vision Inadequate resources Bad politics Lack of sponsors Lack of qualified EA specialists	EA challenges	
TOGAF ZA TAFIM	EA frameworks	EA function
Communication Language and tools Planning Capabilities Gap analysis	EA modeling	

Codes	Categories (Axial Coding)	Themes (Selective Coding)
Organisational culture EA personnel Policy guidelines e-Strategy Structural development Goals and purpose	EA Governance	EA function
System dependencies System complexities IT maturity Business maturity Information sharing	EA maturity	
Environment Promises	EA capabilities	
Punctuality Service rendered Positive attitude Practicality	Service quality	EA principles
Government legislation Government policy User satisfaction Business principles Risk management Cohesion	Design principles	
Top-management EA purpose EA objectives EA delivery model EA e-strategy	Definition of e-Government	Government EA strategy
Health and education Economic government Service-oriented Government-to-business Government-to-employee Government-to-government	Type of e-Government	

2.3 Summary of results of the SLR

In this section, an outline of the review of the 138 articles is presented, which includes the scope of research the articles covered and the spread of research designs and methods. This summary of results provides the depth and background of the themes that emerged in sub-section 2.4.

2.3.1 Scope of the research

The scope of the research shows the spread of the 138 articles over the period 1992 to 2019. The scope includes the diversity of sites of research, regions and issues presented in the articles. Firstly, the distribution of articles over the given period (1992-2019) shows the growing interest in the EA and CI disciplines (Figure 2.6).

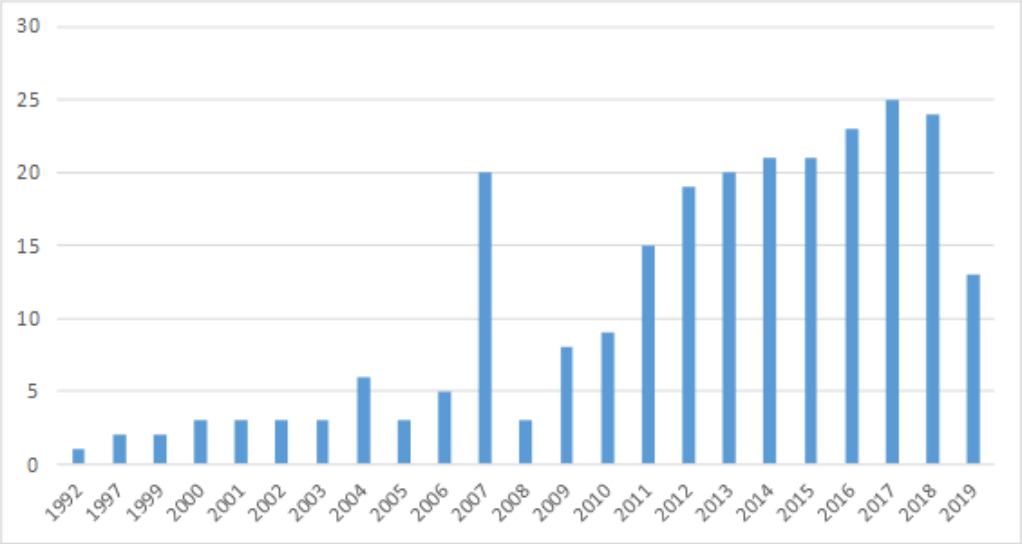

Figure 2.6: Publication distribution from 1992 to 2019

Secondly, the review of 138 articles reveals the diverse scope with emphasis on:

i) The site of the research – whether it is rural, underserved, urban, government or business community;
ii) the region where the most study is conducted – whether it is in Africa, Asia, Europe, Latin America or North America; and
iii) The ICT issues discussed, such as management issues, adoption, implementation and sustainable issues, developmental issues, or socio-technical issues in which the scope of the articles defined the scope of research.

Table 2.3 presents the scope and the spread of the selected research articles. Thirty-eight point seven per cent (38.7%) of the articles referenced were from rural and underserved communities present. Seventeen point seven per cent (17.7%) of the articles were based on government cases, while 29% of the articles were based on business enterprise. The balance was made up of urban articles (2.4%) and instances in which the setting of the paper could not be ascertained (15.3%).

Thirty-six point two per cent (36.2%) of the articles were based on work done in developing the countries of Africa and Asia. In Africa, developing countries such as South Africa, Ghana, Uganda and Kenya featured prominently. There were four

English articles dealing with Latin America. The reason for this lack of articles from Latin America is due to language. Europe and North America, known as developed continents, featured articles from surrounding rural and underserved communities in countries on those continents (Table 2.1).

Table 2.4: Overview of the scope of research
(Adapted from Braun et al., 2013:3)

Category	Subcategory	Result (n)	Result (%)
Location	Rural villages	22	17.7%
	Underserved communities (in urban areas)	26	21.0%
	Urban	3	2.4%
	Government	22	17.7%
	Business	36	29.0%
	Not applicable	19	15.3%
Regions	Africa	23	18.5%
	Asia	22	17.7%
	Europe	28	22.6%
	Latin America	4	3.23%
	North America	13	10.5%
	Developing country	4	3.23%
	Not applicable in any country	42	33.9%
ICT issues addressed	Management issues	30	24.2%
	Adoption, implementation and sustainability issues	38	30.6%
	Developmental issues	36	29.0%
	Socio-technical issues	20	16.1%

The ICT issues addressed in the reviewed literature dealt with adoption, implementation and sustainable issues, followed by developmental and management problems and socio-technical issues. In most articles reviewed, socio-technical issues were not prevalent (Table 2.1 & Table 2.2).

2.3.2 Research designs and methods used in the reviewed literature

The literature review revealed that the use of qualitative research methods in IS was more popular than the use of either quantitative or mixed research methods (Table 2.3). This assertion supports Creswell's (2013) claim that the use of qualitative IS research methods have been on the increase since the 1990s. The study design of 114 reviewed articles was non-experimental, and included descriptive and explorative studies. Eleven studies were experimental and/or quasi-experimental,

explaining the origins, successes and failures of ICT projects, usually without randomised participants.

Table 2.5: Overview of research design and methods

Category	Subcategory	Result (n)	Result (%)
Methods	Quantitative	11	8.8%
	Qualitative	112	89.6%
	Mixed	2	1.6%
Design	Non-experimental	114	91.2%
	Quasi-experimental	9	7.2%
	Experiment	2	1.6%

2.4 SLR findings in terms of the keywords

In this section, the analytic categories formulated in the study from the 138 reviewed articles are presented. The coding process introduced the roles of CI and the EA within rural and underserved communities and the amalgamation of CI and EA emerging from the reviewed articles. The themes sought to understand how ICT4D, CI and EA impact on the rigorous contextualised interpretation of ICT projects within rural and underserved communities.

2.4.1 The role of CI

The role of CI emerges from the reviewed literature as a category derived from the origins and growth of CI, the description and nature of the community, access and the sustainability of ICT projects within the rural and underserved (Figure 2.7). Using ATLAS.ti, each node was linked to quotation(s) from the reviewed articles that support the existence of the code.

2.4.1.1 The origins and growth of CI

This sub-category derived its existence from (i) the historical analysis of CI; (ii) the benefits; and (iii) the challenges that CI has experienced during its growth.

i) The historical analysis of CI

Corey and Wilson (2009) demonstrate that the growth of ICT and the arrival of the Internet brought significant changes to how business was conducted and thus impacted positively on the economy, society, culture, polity and the environment. The integration of the Internet and business yielded positive rewards, emerging as a strong contender in industrialisation and the field of economics (Haigh, 2011).

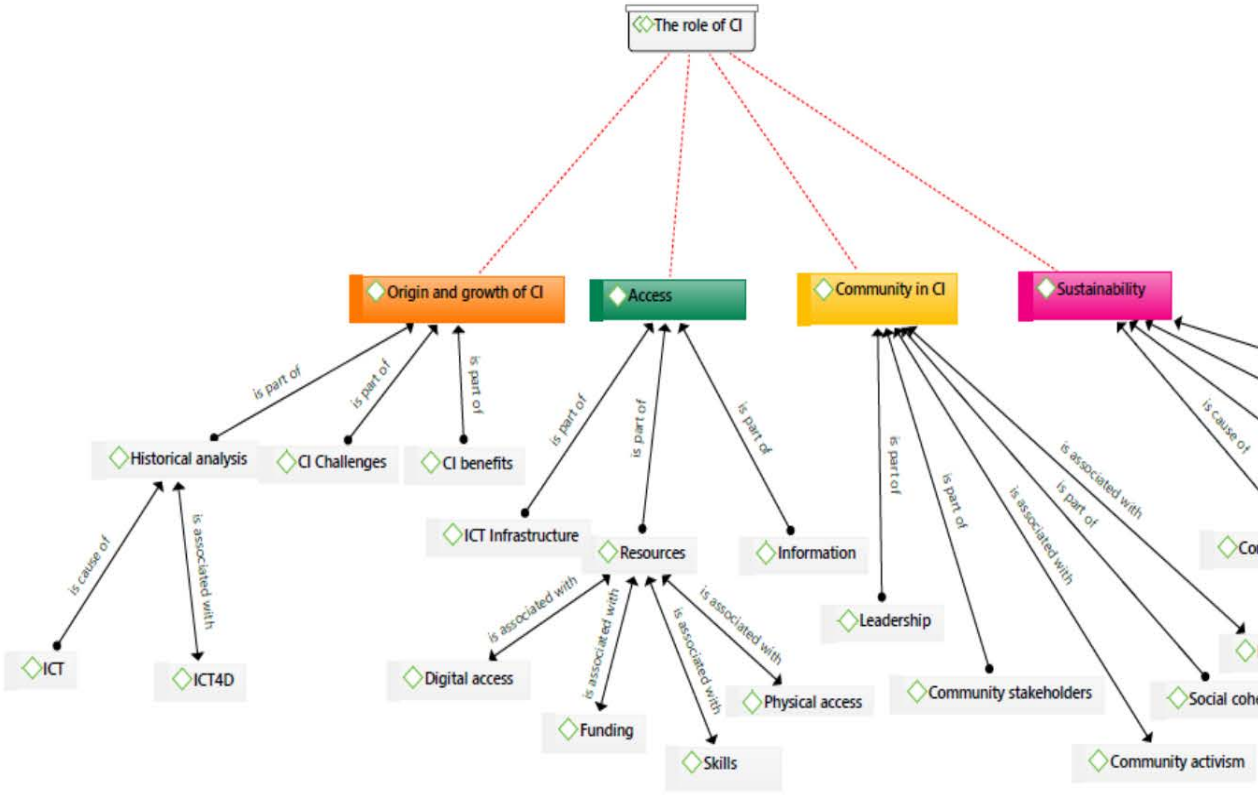

Figure 2.7: Network diagram of the role of CI using ATLAS.ti

The rise of the fourth industrial revolution (4IR) from the previous industrial revolutions such as the steam-powered mechanism, the electrical powered mechanism and later the electronics age, has given rise to a much more focused definition of the term *Information Technology* or *IT*, which gave rise to the much-used term of ICT (Schwab, 2016). The rise of 4IR in the early 21st century has been dramatic and disruptive with an exponential growth in the use of computers that challenges production, management and governance. Productivity, efficiency and flexibility are key issues in emerging technologies (Schwab, 2015). The emerging technologies, such as the Internet of Things (IoT), 5G networks, Artificial Intelligence (AI), Robots, Biometrics and Blockchain, is changing the ICT landscape (Ibid.). However, all this has happened against the backdrop of complex problems, such as unemployment (Claridge, 2004), governance (De Moor, 2015; Bruckmeier, 2018) and poverty (Claridge, 2004; Heeks, 2017; Tucker, 2017; Bin Zaini, 2018) within communities.

Despite the improvements in ICT, sections of the population, especially in developing countries, remain unaffected by the surge in economic development (Lekhanya, 2019; Markowitz, 2019; Mpofu & Nicolaides, 2019). The lack of economic progress resulted to a call from the United Nations (UN) in 1997, that IS

researchers to assist in providing turn-around strategies (Kleine, 2015). The answer to the call was the formulation of the millennium development goals (MDGs) in 2000, addressing the social developmental issues including the employment of ICT tools to address poverty (Mamba & Isabirye, 2015).

Further, in 2003 and 2005, the World Summit on the Information Society (WSIS) was convened by the International Telecommunication Union (ITU), comprising public and private sector representatives (Kleine, 2015). The academic community, under the auspices of the International Federation for Information Processing (IFIP) Working Group (WG) 9.4, held conferences, published journal articles and even wrote books, giving impetus to ICT4D as a discipline (Walsham, 2017). The purpose of ICT4D discipline was to address the digital divide and thus addressing the socioeconomic issues (Qureshi, 2015).

ICT4D developed from ICT. Cohen et al. (2002:35) coined a definition of ICT, stating that ICT connects people in order to gain or share information. Further, Heeks (2010:3) adopted three words to define development: inclusive, enabling and focus. Inclusive implies that services are dispersed to everyone in the community, including the poor. Enabling creates a supportive environment by formulating policies that will improve the livelihood of the poor. Focus targets the rights, interests and the needs of the poor. Heeks (2012:15) conceptualised “digital ICTs as a useful tool for development”.

While ICT grew stronger within ICT4D as a discipline in the 1990s, CI emerged as a discipline concerned with the development of communities and embraced ICT4D in its quest to achieve its purpose (Williams & Durrance, 2009). It was in 1999, at the International Conference on Information Systems (ICIS) in North Carolina, USA, where the first use of the term CI emerged as a “field of research and the practice of community ICT usage” (Day, 2010:260). In 2003, CI emerged as a formal field or discipline. Researchers and community practitioners who had an interest in CI forged links with the newly established Community Informatics Research Network (CIRN) group formed at the Monash University Prato Centre, Italy, in 2003 (Day, 2010). CIRN did not have the formal structure required to recruit members. Even though CIRN operated loosely, allowing anyone to participate voluntarily, interest grew. The first journal publication, known as *Journal of Community Informatics*, was published in January 2004 (Gurstein, 2004).

Alexander et al. (2015:2) argue that ICT4D discipline is not synonymous with CI, but socioeconomic issues in disadvantaged communities bring some intersection points. Ojo (2016:2) further argues that the ICT4D discipline must replicate entities or

structures as “a new global information economy.” The advancement of 4IR sets the pace for all communities to emulate. Singh et al. (2018:2) stress that while ICT4D contributes to “the betterment of persons, communities, or nations,” there is a more substantial need to understand how individuals and communities operate. CI fits the understanding, and hence this research considers CI as critical for rural and underserved communities.

ii) The CI benefits

Several researchers claim that the deployment of telecentres in rural and underserved communities is a benefit of CI worth mentioning (Bailey & Ngwenyama, 2011; Parker et al., 2013; Bailey & Ngwenyama, 2016; Uys & Pather, 2016). Bailey and Ngwenyama (2011) argue that telecentres are a means of encouraging e-participation in rural and the underserved communities, especially among the elderly. Parker et al. (2013) in their research created a space known as Reconstructed Living Lab (RLab) for underserved community members to train in, using social media and mobile phone services to seek jobs and advertise services, using message text techniques. Bailey and Ngwenyama (2016) investigated the role of CI in preventing crime and in contributing to socio-economic development. Uys and Pather (2016) examined how the government could use public access centres (PAC) i.e. telecentres, to address the digital divide in underserved communities. The reviewed literature demonstrates that CI, through using ICT, does affect the livelihood of these communities.

iii) The CI challenges

Concerns raised by Songan et al. (2004) include the cost of the ICT infrastructure and connectivity in rural and underserved communities, foreign language of instruction in implementing ICT resources, coordinated approaches, skilled personnel, and an awareness about development in ICTs among rural communities.

According to Goodwin (2007), CI and the government tend to clash over the need to allow its citizens the independence to implement ICT projects they want to, without government interference. Governments tend to be overly concerned about public spending, resulting in community ICT projects shutting down.

Parra et al.’s (2015) research deals with issues of trust and confidence when working with rural and underserved communities. The non-existent, or sometimes eroded, trust between the community and the researcher is a challenge. Researchers do not often build trust with community members, who regard them as ‘research subjects’ (Ibid.). Hespanhol et al. (2018) are concerned with the lack of

trust and exclusion in digitisation of indigenous community members, young people, women, the elderly, migrants and refugees.

2.4.1.2 Community within CI

The literature review revealed that community leadership (Gurstein, 2000; Wallace et al., 2015; McMahon et al., 2017); community stakeholders (Halabi et al., 2015); community activism and social cohesion (Arnold & Stillman, 2013; Adomah-Afari, 2015; Tabassum & Yeo, 2015; Gayatri et al., 2018; Nemer, 2018; Grzeslo, 2019); and politics (Arnold & Stillman, 2013; Day, 2018) contribute to defining the role of CI.

The concept of the community has been the subject of debate since the inception of CI. Gurstein (2000), the 'father' of CI, contributes to the debate by highlighting two types of the community, namely, virtual and physical communities. Virtual communities are tied together by social networks. Physical communities live together within a geographic area. Gurstein (2007) embraces the Latin concept of '*communis'*, meaning that people share the shared public space. Peck's (2010) view of the community deals with the inclusivity of the community members, while Adomah-Afari's (2015:826) perception of the community is "complete structures" that serve its members. Wallace et al. (2015) argue that stable community structures have good leaders at the helm.

Green and Haines (2015) argue that it is within community development that assets, such as human capital, social reform, financial built, environmental and cultural awareness, are built. Roberts et al. (2016) opine that community development strengthens the communities' resilience that is required to improve the quality of life within a community. Kassongo et al. (2018) summarise this by articulating that ICTs have a significant role to play in addressing community development issues. Community-based ICT projects formulate a critical component in community development.

CI has been built on the description of shared and solidarity community values. Williams and Durrance (2009) argue that community in most literature refers to shared physical space. Therefore, CI resides in community libraries, community activities and spaces where communities are active.

Goodwin (2012) opines that activism is embedded in CI. It is necessary to understand the dynamic nature of the community, its cultural affairs, politics and the socio-economic development of the community. Through dynamic and adaptable activism, vigorous interaction or debates are critical to improve the well-being of individuals within the community, and so CI is placed at the centre of community-

based development. Furthermore, Arnold and Stillman (2013) state that activists need to coerce community members by adopting a position of authority and legitimacy to agitate for social change that will improve the socio-economic status of the community. Copeland and de Moor (2018) propose digital storytelling, a form of narrating stories using digital formats such as videos, as a kind of activism to reach the communities with specific messages.

The multidisciplinary and interdisciplinary nature of CI involves anthropologists, sociologists, computer scientists and management information systems specialists. This places CI in a prime position to learn, adapt and grow in political philosophy, sociology and social theory, all of which are a necessary conditions required to address challenges in communities (Arnold & Stillman, 2013). De Moor (2015) argues that CI supports socio-technical systems designed to contribute to a community's welfare.

2.4.1.3 Access

The reviewed literature demonstrates the critical need for communities to have access to a functioning ICT infrastructure (Poudel, 2010; Cepolina & Ghiara, 2013; Ojo, 2016; Mehra et al., 2017) and to have access to resources, such as funding, skills and information (Pigg, 2001; Songan et al., 2004; Han et al., 2016). Poudel (2010) demonstrates that ICT infrastructure is critical to ensure the rapid growth of the rural economy, especially for communities located in deep and far-flung areas.

2.4.1.4 Sustainability

Pigg (2005) argues that CI sustainability is maintained by local services, community and economic development, and environmental development. However, Stillman and Stoecker (2008) cite sustainability as an obstacle to CI. According to Mehra et al. (2017), progress has been made with addressing sustainability in CI.

2.4.1.5 Findings

The SLR has found the following:

i) The descriptive analysis of CI has a vital role in defining how CI can assist in community development.
ii) The participation and contribution of the community have a critical role in CI.
iii) The community access to resources is critical for community development.
iv) Sustainability is essential for community growth.

2.4.2 The role of EA

The high-level category known as the role of EA has emerged from the abstraction of the reviewed literature, with sub-categories, into four themes, as discussed below.

2.4.2.1 Descriptive analysis of EA

In this sub-category, the analysis of the description of EA and EA management (EAM), the benefits of EA (Shanks et al., 2018), and the EA challenges (Olsen & Trelsgård, 2016; Julia et al., 2017; Ajer & Olsen, 2018) as provided by the reviewed literature, will be presented.

Analysis of EA: Various researchers/practitioners over the years have argued that there exists no single universal definition for EA; rather, a variety of definitions has been presented (Rood 1994; Schneider et al., 2014; Saint-Louis & Lapalme, 2018). EA researchers trace the emergence of EA to Zachman in 1987 (Hjort-Madsen & Pries-Heje, 2009; Al-Nasrawi & Ibrahim, 2013; Dang & Pekkola, 2017a). Kotusev (2016) disputes this position by arguing that EA originated in the 1960s, arising from IBM's Business Systems Planning (BSP) methodology. His stance about the origins and history of EA is that EA has evolved over three generations: the pre-EA (BSP) of the 1960s to the 1980s; early EA, starting from the 1980s to the 1990s; and modern EA starting from 1990s.

Despite the differences about the origin and definitions of EA, Zachman (1987) states that an EA framework logically brings together different components of the system in a manner that will make up a holistic enterprise. Whitman et al. (2001) further state that EA can adapt to the dynamic realities of the changing environment. The EA blueprint assists in understanding the current enterprise status and the future developments required to meet an organisation's objectives.

Šaša and Krisper (2011) address EA patterns for business process analysis, which compares the different EA solutions and provides guidelines for the development of target EA, based on the analysis of existing EA. In other words, comparing the "as-is EA" with the "to-be EA" scenario enables EA analysis to move beyond EA representation and communication.

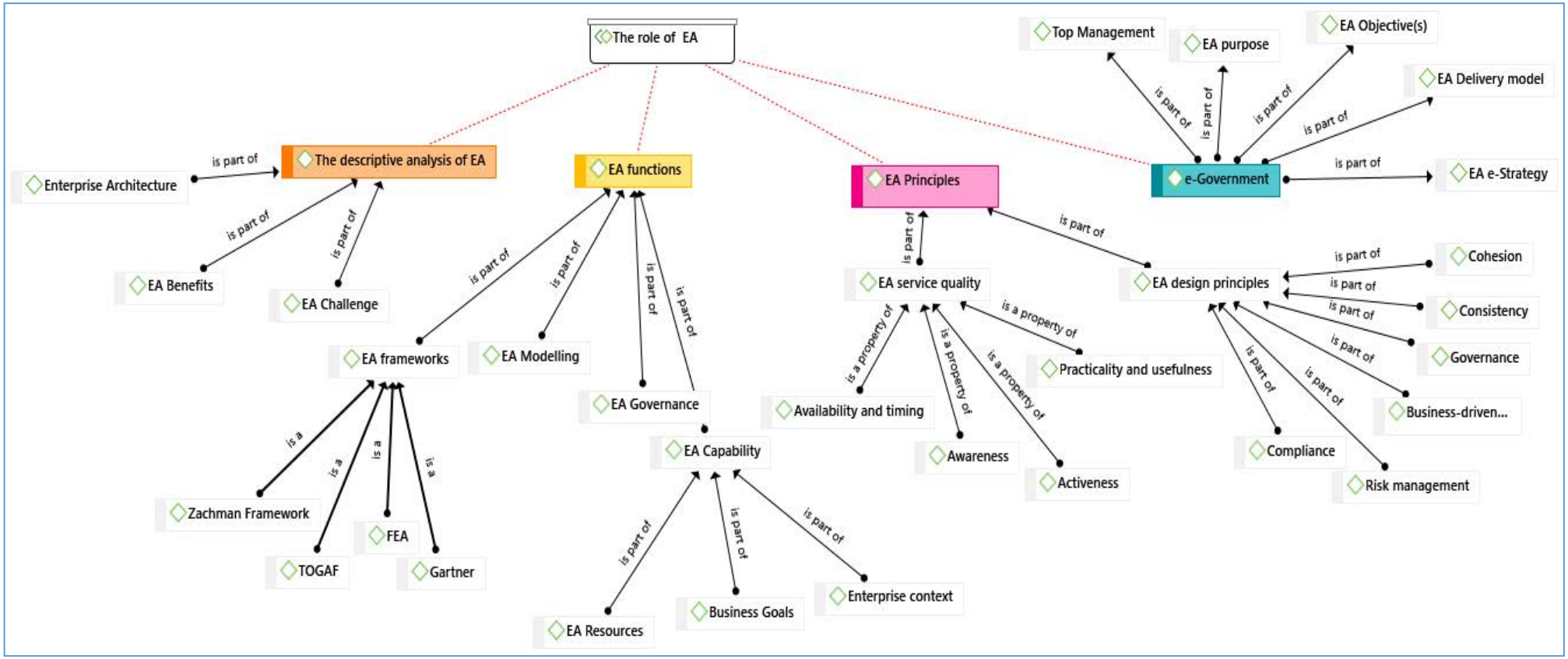

Figure 2.8: Network diagram of the role of EA using ATLAS.ti

Foorthuis et al.'s (2016) concern is that EA research does not adequately explain the EA benefits, but instead presents how to create EA functions. The authors contend that further empirical research is required to understand the value of EA. Korhonen et al. (2016) argue that EAs traditional descriptive view of standardisation and integration should shift to the adaptive and changing business environment. Gong and Janssen (2019) argue that organisations should move beyond the idea that EA provides value, to an understanding that EA is an instrument enabling the creation of value. Because of Nurmi et al.'s (2019) conclusions about varying definitions, EA's scope is evolving and growing, extending EA to new frontiers that require new or adapted definitions.

EA benefits: The fact is that EA is growing and extending its boundaries. Tamm et al. (2011) view EA as leading the transformation in interpreting new principles and capabilities, and turning a new vision into strategies that can realise new goals. Tamm et al. (2011) explicitly state four EA benefits: (i) organisational alignment in terms of the bridging business processes and IT; (ii) availability of shared or new information; (iii) resources should be optimised to reduce redundancy and cost; and (iv) resources should be used to improve integration and interoperability. Plessius et al. (2018) do not simply list the EA benefits; they have created a two-dimensional relational EA value framework (EAVF), integrating EA activities, EA costs, organisational goals and EA activities in order to provide a focused relationship. Shanks et al. (2018) posit that organisational benefits provide a better agility, competition and value.

EA challenges: Olsen and Trelsgård (2016) cite the lack of vision from leaders as an impediment to EA efforts. Dang and Pekkola (2017b) further note that an organisation's inability to regulate and legislate EA activities, plagued by politics and sponsors, renders the organisation inactive. EA teams fail to coordinate and collaborate as they should. Ajer and Olsen (2018) indicate that the fundamental challenge is stakeholders with little or no understanding of EA. Some of the stakeholders have financial decision-making powers. Julia et al. (2017) argue that IT solutions are inadequate to meet business expectations and, thus, render the process of integration and interoperability ineffective.

2.4.2.2 Function of EA

The reviewed literature demonstrates how EA could be implemented to maximise gains or profits for the organisation. EA frameworks, modeling and maturity define the function of EA.

EA frameworks: The general description of EA frameworks in the literature defines these frameworks as types or forms within which architectures are created using different approaches (Haki et al., 2012; Schmidt et al. 2015; Korhonen et al., 2016). Sessions (2007) and Cameron and Mcmillan (2013) identifies four dominating EA frameworks that organisations and governments use: the Zachman Framework (ZF); the Open Group Architecture (TOGAF); the Federal Enterprise Architecture (FEA); and Gartner. ZF and TOGAF are the dominant EA frameworks in use.

EA modeling: EA modeling facilitates the analysis and design phases of EA creation. During the EA creation process, a gap analysis and a capability analysis are undertaken and road maps are designed using the EA modeling language and tools. EA planning and implementation is facilitated within EA modeling. Communication between stakeholders and architects play a critical role during EA creation (Dam et al., 2015). The reviewed literature attributes EA modeling to a four-layered model of architecture, comprising business, information, data and infrastructure architectures (Fischer et al., 2007; Haki et al., 2012; Niemi & Pekkola, 2013; Saint-Louis et al., 2017).

EA governance: EA governance entails managing an EA by providing direction and purpose. Bui (2017) emphasises that EA governance includes an understanding of the structure and the formulation of policies that guide the organisation. According to Bui (2017), the chief architect or EA director is a critical position in respect to leading the EA organisation. There can be enterprise architects, depending on the size of the organisation, who monitor the operations and monitor the EA. Rahimi et al. (2015) argue that the relationship between the chief architect and the organisation's leadership needs to be cordial to ensure that the organisation's goal is met.

EA maturity: EA maturity improves the relationship between IT and business (Vallerand et al., 2017; Robertson et al., 2018; Van den Berg et al., 2019). Vallerand et al. (2017) argue that EA maturity enhances information sharing, reduces information systems complexity, and reduces dependency on crucial resources. The literature reports on several maturity models (Van Steenbergen et al., 2010; Meyer et al., 2011; Vallerand et al., 2017). Roberts et al. (2018) propose a four-stage EA maturity model, ranging from stage 1 representing the lowest level, to stage 4 as the highest level. Stage 1 involves early planning and learning about the roles. Stage 2 involves limited integration between EA functions and organisational units. Stage 3 involves more integration. Stage 4 involves the highest maturity level of planning, with an effective lever for driving organisational change.

EA capability: Gill (2015) views EA capability as the provision of the fundamental concepts or properties required in the EA environment to fulfil a task. Shanks et al. (2018) explain EA capability as the ability to provide services to an organisation based on the promises made.

2.4.2.3 EA principles

The reviewed literature reveals high-level guiding principles that are manifest within the EA, including EA service quality (Niemi & Pekkola, 2013) and design principles (EsmaelZadeh et al., 2014). Niemi and Pekkola (2013) suggest that four service qualities make EA meaningful: (i) EA services must be available on time; (ii) EA users should be aware of services rendered; (iii) an active attitude that motivates the users should be displayed at all time; and (iv) EA services should be practical and useful to the users. Hacks and Timm (2018) add validity, relevance and clarity of the EA service to this list.

EsmaelZadeh et al. (2014) argue that in terms of EA design principles, the following criteria should apply to every EA that is built:

i) It must be compliant with the organisation's or government's regulatory policies;
ii) It must be business-driven in order to ascertain that the business goals are met;
iii) The service must be consistent with the expectations of the user;
iv) The governance must be relevant, with relevant internal qualities and performance management;
v) Risk management should be able to ascertain the potential risks; and
vi) It must involve cohesion, which to do with resources that need to be aligned to the business objectives and integrated into its operations for efficiency.

2.4.2.4 The EA for e-Government

Governments' methods of rule, regulate or control are as old as history. Citizens have expectations about their governments' delivery of excellent education, quality healthcare, adequate security, and stable infrastructure. The delivery of these expectations is often dependant on the government's capacity. The ability to use ICT within the government enhances the capacity and performance to deliver these expectations (Mensah, 2020). As a result, most governments of the world have resorted to electronic governments (e-governments) to deliver better services, which are considered critical digital governance (Nguyen, 2016).

Further to e-government's diverse implementation and sometimes challenging access of applications, Saha (2010) indicates that governments are streamlined by implementing EA within e-government to promote a citizen-centric, results-oriented, and market-related approach. Lapalme et al. (2016:104) further add that EA is well-positioned to build a socio-technical organisation, promoting interaction between citizens and government. Guo and Gao (2020) argue that the best way of balancing technical challenges and non-technical challenges is through the application of EA within e-Government.

The following criteria were identified from the literature review as critical for e-government: top management (Banaeianjahromi, 2018); EA purpose/aim (Dang Pekkola, 2017a); EA objectives (Halawi et al., 2019); EA delivery model (Kotzé & Alberts, 2017); and EA and government e-strategy (Agarwal et al., 2017).

Rorissa and Demissie's (2010:161) analysis of the progress concerning EA's use in African government has been slow due to "the lack of infrastructure, low literacy rates, slow economic development and a variety of cultural factors." South Africa has not been left unscathed in the implementation of e-governments (Mutula & Mostert, 2010; Murenzi & Olivier, 2017; Singh & Travica, 2018). Singh and Travica's (2018) article lists a number of partial failure and failed e-government initiatives in SA. This failure is not limited to SA e-government initiates, government EA is not visible. There is scarce literature and government documents outlining the EA initiatives within government. The last visible attempt is the Government-Wide Enterprise System (GWEA) of 2010 (Makovhololo & Ruxwana, 2017). Twinomurinzi (2012) argues that Chief Information Officers in SA government do not participate in GWEA forums.

The SLR has found the following:

i) The description of EA has a significant role to play in the organisation's goals;
ii) The choice to implement EA has a critical significance value for the organisation;
iii) The quality of service provided by the EA is significant in terms of the sustainability of the organisation; and
iv) EA plays a significant role in defining the e-strategy of the government.

EA plays a critical role in building the organisation.

2.4.3 The interdisciplinarity of CI and EA

During the past decade, researchers have been calling for more interdisciplinarity in the IS field (Walsham, 2012; Walsham, 2017; Tarafdar & Davison, 2018; Chughtai et al., 2020; Philip & Williams, 2019). Walsham (2017) reminds researchers that IS is a convergence of various fields, such as sociology, economics and anthropology. Tarafdar and Davison (2018) assert that IS has its diverse roots in human activities. Chughtai et al. (2020:124) invoke the term 'demarginalisation' from critical theory and place it on par with interdisciplinarity. Demarginalisation is a call for marginalised topics such as power relations in an organisation and problematic legacy policies in the context of ICTs (Ibid.). In addition, Philip and Williams (2019) recognise that the digital economy offers the rural and underserved communities an opportunity to apply interdisciplinary processes in order to respond to the building of persistent digital divide.

Barry et al. (2008) use synthesis, collaboration or integration of two or more disciplines as synonyms of interdisciplinarity to elucidate human activity. Human development within a community is a complex phenomenon, requiring broad-spectrum interventions at multiple-levels (Goncalves, 2017). According to Szostak (2017), interdisciplinary researchers aspire to creativity and the adoption of integrative and interdisciplinary processes in order to encourage creativity in providing solutions to the complex problems. Bruckmeier (2018) argues that interdisciplinary research opens up disciplinary boundaries for new insights. Beck et al. (2019:1) argue that complex "wicked socio-ecological problems" (or difficult to find solutions) require an interdisciplinary approach.

Walsham (2012), and later Qureshi (2015), argue that the IS discipline is interlinked, and is continuously learning from other disciplines. This interlink is known as interdisciplinarity, which is demonstrated in the examples that follow:

Firstly, Kaltenthaler et al.'s (2018) interdisciplinary linkage of information created knowledge by the collaboration between health and archaeological databases experts in diverse domains. The integrated approach of interdisciplinarity, found the new insights provided by 'inter-domain knowledge' to be useful in providing broader information to health practitioners.

Secondly, Chen et al. (2018) needed to understand how to market the idea of a drone delivery service of medicines to rural and underserved communities. To achieve this, an interdisciplinary study, which required knowledge from marketing, technology adoption and social network factors, was undertaken (Chen et al., 2018:8).

Thirdly, Azevedo et al. (2019) formulated an interdisciplinary mental-health team comprising of mental-health professionals, clinicians and ICT technologists. The team assisted retired rural military veterans to develop a strategy to prevent domestic violence.

Fourthly, Philip and Williams (2019) used an interdisciplinary process to instigate a rural Public Access Wi-Fi Services (PAWS) project in rural and underserved communities. The interdisciplinary collaboration consisted of Internet engineers, human geographers and satellite broadband experts.

The reviewed literature's significant finding is that interdisciplinary processes are substantial to address the persistent socio-economic digital divide. Harris et al. (2017) stress the critical importance of people and technology relating and participating in a meaningful manner to improve socio-economic activities. Mubarak et al. (2020) stress the government's role in managing a favourable climate for operating ICT strategies. This climate encourages suitable ICT investments. Since digital divide challenges are multidimensional, cutting across academics, government policies, digital inclusion or exclusions (Ibid.), Rich and Pather (2020) posit that people, technology, organisation, and the environment should not only train but allow the community to engage meaningfully in the prospects of reducing the digital divide. The digital divide cannot be entirely eradicated but can be reduced to manageable levels (Mubarak et al., 2020).

Given the initial research, the interdisciplinary processes of integrating EA and CI have potential benefits of encouraging the community's participation in charting community development. It further strengthens the synthesis of ideas from the EA and CI in defining the relationship between the government and the community. Interdisciplinary teams and knowledge areas are critical in responding to the needs of human development.

2.5 Discussion

This section provides a salient analysis for this SLR study. The first sub-section deals with a general discussion of the integration of CI and EA, while the second sub-section presents how prior research has responded to the research questions.

2.5.1 General discussion

Development implies growth, which leads to becoming a better person. Two decades ago, Sen (2001:3) explained that “real freedom makes people better; enjoying life in its full potential. Development expands this freedom to everyone”. However, a decade later, Avgerou (2010) stated that development is hamstrung by

conflicting interests and power politics locally, nationally and internationally. This is prevalent in contemporary global and national politics, and within international development agencies. Recently, Lwoga and Sangeda (2019) demonstrated that an ICT developmental tool is capable of changing the political discourse and the financial world in such a way that it results in the relegation of the marginalised into the abyss of digital exclusion.

The SLR reinforces the idea of development in rural and underserved communities that builds on interdisciplinary subject, where the community and the government focus on politics, culture, geography, and socioeconomic perspectives. Within this development, rural and underserved communities, together with the government can communicate, participate and collaborate to achieve a better life for all.

2.5.2 Literature response to the research questions posed

Sub-research question 1 sought to understand the unique challenges faced by rural and underserved communities when considering ICT implementation for their benefit:

SRQ 1: Why are rural and underserved communities not benefiting from CI when implementing community-based ICT projects?

Response: Rural and underserved communities' challenges extend beyond just low-cost access to the ICT infrastructure; in other words, the technical issues they face continue to lead to socio-cultural and non-technical problems. Technology as a standalone commodity cannot solve all of the problems that humans face. The rural communities must be involved in choosing relevant ICT projects that address socio-economic and political empowerment. Dé et al. (2018:63) describe the dynamics of change as "an understanding of the social, economic and political situation and the manner in which ICT creates the conditions for alteration of these circumstances, for development".

SRQ 2: What is the role of government EA in implementing community-based ICT projects?

Response: The role of EA in the government or public sectors is well documented in the literature. Weerakkody et al. (2007:18) argue that EA's strength lies in "bringing together both the front and back-office focus along with a governance model that guides the use of IS from a business perspective". Ojo et al. (2012) claim that top-management has a critical role to play in rallying the participation of business units in government to raise the maturity of EA practice. Saha (2012:10)

argues that EA in government was necessary to encourage active citizenship, which challenges "business silos, standardized technology, rationalized data and applications and business modularity". Dang and Pekkola (2017b) could not ignore the increasing focus on EA development while there was a muted approach to EA practice and activities. However, while the role of EA is explicitly defined by improving internal government processes, there is a dearth of literature focused on community-based ICT projects. EA in government requires external coverage on how communities could be assisted in EA development.

SRQ 3: How can EA and CI be integrated to address community needs in the rural and underserved communities?

Response: Integrating the two disciplines, CI and EA has the potential to balance different interests and needs, and to deal with complex questions that may arise. Both disciplines have the potential to support the successful implementation of development programmes. CI, based on the community, has the power to influence, teach and help the community to participate in their day-to-day activities. While government adoption of EA assists with a holistic approach to how to serve the citizens, EA also helps to reduce redundancy and the bureaucracy that often hampers the government's ability to respond rapidly to community service delivery.

Walsham (2012:90) questions whether "it is possible or desirable to try to identify and isolate an IS-specific research topic in a particular research domain, or whether it is better to work closely with other researchers in an interdisciplinary way". It is plausible to call on researchers, in this case, CI and EA researchers, practitioners and community leaders, to provide a shared vision on advancing the development of community-based ICT projects.

Primary research question:

PRQ: How can an Enterprise Architecture for Community Development (EA4CD) framework be developed to integrate EA, CI and community needs to assist with the implementation of community-based ICT projects in rural and underserved communities?

Response: Literature does not present an EA4CD framework. However, because of the persistent socio-technical challenges experienced in rural and underserved communities, the required role of EA within government extended to communities, and the shared responsibility within EA and CI practitioners, ensuring that ICT projects serve the communities, thus, EA4CD becomes an imperative.

2.6 Interpretations

2.6.1 CI implementation and community-based development

The challenges faced by underserved and rural communities extend beyond just low-cost access to the ICT infrastructure. The challenges include the socio-cultural, non-technical problems, such as a lack of skills, a lack of access to funding, and a lack of proper communication between the government and communities. This socio-cultural dimension requires further understanding.

2.6.2 Role of EA in ICT strategies for community-based development

The role of EA can be aptly defined through an EA framework that connects to CI principles. CI and EA have the potential to balance different interests and needs from opposite ends as well as deal with complex questions that may arise from the communities and from those who provide services. CI that is based on the community has the power to influence, teach and help the community to participate in their day-to-day activities. The government's EA framework offers a holistic approach to meeting the aspirations of the communities. EA addresses redundancy and bureaucracy that often hampers the government's rapid response to service delivery. Walsham (2012:90) wonders whether "it is possible or desirable to try to identify and isolate an IS-specific research topic in a particular research domain, or whether it is better to work closely with other researchers in an interdisciplinary way". The latter is possible.

2.6.3 Gaps in the reviewed literature

The literature review demonstrates a dearth of interdisciplinary research studies, suggesting that a 'silo mentality' exists. Researchers appear to have chosen to focus on their discipline only, neglecting to indulge in other disciplines. Walsham (2017:35) decries this state of affairs, saying that "[t]he academic world tends to be structured in single disciplinary silos and career progression normally takes place within those silos". The author pleads for more interdisciplinarity in IS, and the breaking down of the perceived disciplinary silos that negatively affect service delivery. The apparent lack of interdisciplinarity in identifying the role of EA in community-based development in rural and underserved communities emphasises gaps in research, such as the theoretical research gap, the contradictory research gap and the empirical research gap.

The theoretical research gap highlights the missing theory required to generate new insights. Since the 1990s, CI and EA have matured as disciplines, creating new theory in their respective disciplines. However, Sweeney and Rhinesmith (2016) allege that CI has placed weight on access, lack of skills, and literacy without really

demonstrating how the power dynamics, such as politics and culture, play out within communities. Simon et al. (2013) identify three areas of EA growth requiring further research. These areas are the frameworks of design, operation of management, and conception and modeling. Foorthuis et al. (2016) further argue that EA research lacks the explanatory theory required to guarantee that EA is consistent with the empirical world. The prior literature concentrated mainly on how to create EAs, or how EA functions, but neglected to explain how a given EA can realise its benefits. Gomez et al. (2012:73) charge that EA research focuses more on the descriptive knowledge and less on analytical knowledge.

The contradictory evidence research gap emanates from the fact that the results of the reviewed literature become inconsistent when subjected to detailed scrutiny (Müller-Bloch & Kranz, 2015). A review of the past three decades of literature demonstrates the need for ICT and development to facilitate the creation of a better world for all. For both CI and EA, previous literature has vividly described the importance of development. Stillman and Linger (2009:257) argue for "the centrality of 'people and place' in community development…" Alwadain et al. (2016:10) support EA development that engages with the organisational activities that require EA evolution. Nel and Kroeze (2008) note the unintended consequences of ICT, the producing of cyborgs that are addicted to technology. Technological determinism seems to dictate the direction of ICT within the post-modernist society, where no rules apply (Nel & Kroeze, 2008).

Furthermore, Leye (2009:34) argues that ICT opportunities are determined by political and institutional decisions. This position views people as beneficiaries of technology without honestly engaging them. This contradictory evidence gap warrants further research in order to understand tensions, contradictions and inequalities better, in respect to the diffusion of ICT, especially in underserved and impoverished rural communities.

Empirical investigations, which include ethnographic studies, case studies with a view of generalising, and surveys, are necessarily required to back up theoretical studies. Empirical research is critical to advancing IS research because of the underpinning rigour and relevance of the approach to research (Benbasat & Zmud, 1999; Lyytinen, 1999; Hevner et al., 2004). There is a dearth of empirical research that has evaluated the role of EA in community-based development and on the integration of CI and EA. Mamba and Isabirye (2015) decry the high failure rates of ICT projects, which manifests in a lack of understanding of the subjects of the IS

study. This lack of understanding illustrates a lack of empirically developed theory that speaks directly to the targeted audience.

2.7 Conclusion and recommendations

There is a growing need for IS to be seen as an interdisciplinary field of study, one that, together with ICT4D, CI and EA, should be strengthened in order to prevent digital exclusion. In all these disciplines, ICT has become a significant partner and a unifier. ICT4D's role is currently experienced in CI (Kleine, 2015), but is not as implicit in EA. However, ICT plays a crucial role in providing an IT strategy for EA (Gregor et al., 2007). CI and EA are two disciplines with different approaches but with the common goal of providing better service. CI employs ICT as a tool to empower and support communities, while EA acts as an integrated tool to provide services.

Prior literature has aptly demonstrated that communities and ICT providers, especially those who are entrusted with ensuring that holistic approach services are guaranteed, must regularly engage with each other in order to find common ground. Winschiers-Theophilus et al. (2015:100) stress the point that research should avoid the proverbial "white elephants".

The theoretical contribution of this SLR study is seen in the growing field of IS, especially in ICT projects designed and implemented in the rural and underserved communities of developing countries. The study has drawn on, and is contributing to, scholarly published literature on the diffusion and implementation of ICTs in the poor rural and underserved communities. The research also demonstrates the process of setting up a qualitative SLR.

Empirical research is required to underpin the theory gleaned from this SLR study. Klein and Myers (1999) call for the next agenda to precisely define the nature of development and explain the role of new technologies, as well as deal with the need for interdisciplinarity between disciplines that have common interests.

In conclusion, Sen (2001:11) argues that, "the success … has to be judged ultimately by regarding what it [development] does to the lives of human beings". Poor, rural and underserved communities remain fixed in poverty and degradation. Walsham (2017:37) warns that researchers and practitioners "should not see [them]selves as the 'experts' bringing top-down solutions to 'beneficiaries'". Instead, researchers and practitioners should see themselves as co-contributors with everyone else since all people throughout the world have views about "development in their particular context".

2.8 The limitation of SLR

For this study, 138 English-written literature reviews were sampled, representing a broad spectrum of views in the emerging and widespread disciplines of CI and EA. This sample may not cover all the opinions expressed within the discipline; however, the dominant views within the disciplines are represented. The reported studies represent the majority of opinions.

Biased views in this study may not be discounted, although objectivity was maintained and kept as a balance in this study. It must be noted that the study is part of an ongoing research study.

2.9 Summary

The SLR dealt with the growth pathway for ICT within the ICT4D, CI and EA disciplines towards improving the living conditions of the citizens of the world. Groundbreaking and effective ICT projects have enabled and empowered citizens to reach out to new markets. Research in ICT is forecasting an imminent drastic change, through the adoption of 4IR, which will affect how people live. However, rural and underserved communities continue to experience slow progress in ICT development. These communities continue to experience exclusion from the global economy, thus continuing to live in poverty.

In this chapter, the researcher demonstrated the critical need of interdisciplinary integration of EA, implemented by the government, and CI in rural and underserved communities in order to harness the synergies that exist between the two disciplines aimed at addressing the implementation of the community-based ICT development projects. Myers (1999) calls on the next agenda to define the nature of development precisely, to explain the role of new technologies, and to take into account the need for interdisciplinarity between disciplines that have common interests.

In the next chapter, the researcher will present the theoretical and conceptual framework required to support this research. The theoretical framework provides a particular perspective or lens through which the purpose and the structure of the research should be viewed. The conceptual framework will describe the synthesis of concepts and the relationships between the concepts.

3. CHAPTER THREE: THEORETICAL FRAMEWORK

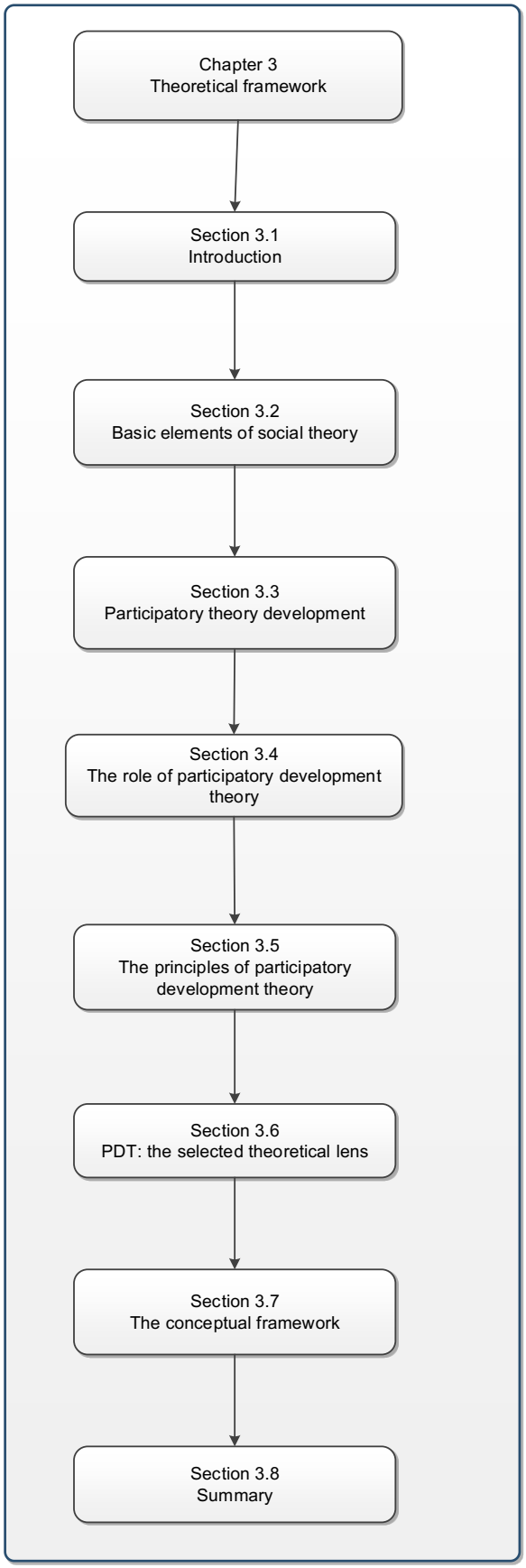

Figure 3.1: Chapter Three flow

3.1 Introduction

In the previous chapter, the Systematic Literature Review, the researcher demonstrated how the integration of CI and EA could be useful for supporting the implementation of community-based ICT projects in rural and underserved communities. The dearth of literature regarding the integration of CI and EA highlights three research gaps, useful for implementing community-based ICT projects in rural and underserved communities. Firstly, the theoretical gap calls for the application of analytical knowledge that would address the missing theory required to improve the development, deployment and the implementation of community-based ICT projects. Secondly, the contradictory research gap emphasises the need to reconcile the inconsistency of successes that ICT research experienced, against the substantial ICT failures that have been recorded. Thirdly, the empirical research gap demonstrates the dearth of empirical research that has evaluated the role of EA in community-based development, or the integration of CI and EA. The implementation of community-based ICT projects and the identified research gaps were analysed using participatory development theory (PDT).

In this chapter, the researcher presents one of the analytic socio-technical theories, PDT, which was used as a lens through which to explore the systematic descriptions, explanations, predictions or prescriptions which formulate how societies can participate in changing and developing communities (Figure 3.1). Furthermore, PDT assists in defining the social behaviour, power and social structures that are necessary for integrating CI and EA for implementing community-based ICT projects. PDT provides a lens through which the research process was designed and undertaken and the findings were obtained. Through the PDT lens, community development is defined in a synchronised manner with both context and time.

In section 3.2, basic elements of the socio-technical theory are presented. In section 3.3, the researcher discusses PDT, while PDT's role is dealt with in section 3.4. The principles of PDT are discussed in section 3.5, while section 3.6 involves a discussion on similar social theories with the view of explaining why PDT was the socio-technical theory of choice. The conceptual framework is presented by the researcher in section 3.7, and the chapter closes with a summary, in section 3.8.

3.2 Basic elements of social theory

Social researchers are critical in understanding how people react to services that affect their needs. Society's participation in social research determines the acceptance of the service provided. Crotty (1998) demonstrates that social research

progresses through four basic elements (Figure 3.2). For example, Kelly et al. (2018) and Hathcoat et al. (2019) applied Crotty's principle to their studies. Firstly, the epistemological stance in this research is that constructionism constructs knowledge through design. This stance is further discussed in section 5.2. Secondly, the theoretical position adopted in this study provides for a deep understanding of the particular context within the broader context. This understanding offers reasons for such a context. The context of this study is elaborated on by an understanding of PDT. PDT is further explicated in section 3.6 of this chapter. Thirdly, the methodological stance, which depends on the theoretical stance, scientifically justifies the selected methods necessary to understand a particular phenomenon. DSR, as the methodology used for this study, is presented in Chapter Five. Saunders et al.'s (2019) methodological approach known as the 'research onion' (Figure 5.2) is used in this study. Fourthly, methods are applied techniques and procedures used to find answers to the current problem.

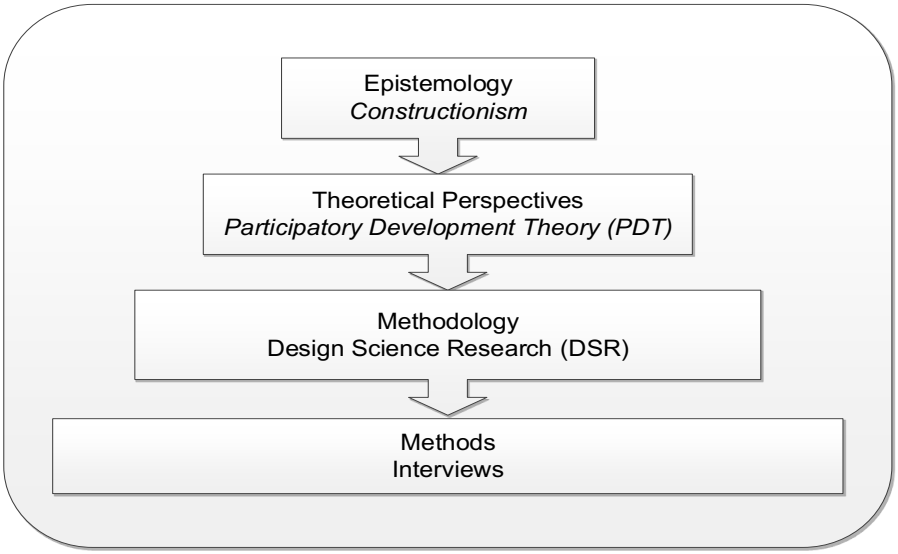

Figure 3.2: Four basic elements of social theory
(Source: Crotty, 1998:4)

3.3 Participatory development theory (PDT)

The word 'participation' originated from Aristotle's (384-322 BC) way of distinguishing between eternal universal knowledge (*epistêmê*) and an action (*technê*) that produces an artefact (Gregor & Hevner, 2013). Aristotle derived a technical term, "*praxis*", often and simplistically related to *practice*, which relates to doing some activity.

However, *praxis* is a special kind of practice involving theoretical thinking. In the 19th century, Karl Marx modified Aristotelean praxis into a revolutionary praxis where human beings reflected on their environment, and consciously changed the

environment to suit their needs (Eikeland, 2015). In the 1970s there was a paradigm shift towards PDT, with the Brazilian philosopher, Paulo Freire, championing a theory that "gave local people ownership and control over the development" (Haikin, 2012:2). Freire brought the Marxist notion of praxis closer to action research and action learning.

PDT has no single definition, since its definition depends on whether one subscribes to a social movement or to institutional studies. Campbell and Vainio-Mattila (2003:420) identified a group of words or terms that anchor most definitions of PDT. First, the "actor's participation" or "people's participation", and "community" or "people's own development" or "community development". Second, "participation" dominates most definitions. These words indicate a significant shift from passive engagement to active engagement. For example, Dearden and Haider Rizvi (2008:83) define participation as "a process by which people, especially disadvantaged people, influence decisions that affect them". Dearden and Haider Rizvi (2015) further outline what questions are answered by PDT. PDT should answer the following questions: (i) Participation in what? (ii) Why participate? (iii) When to participate? (iv) Where does participation happen? (v) Who participates? (vi) How to participate? Answering these questions ensures genuine participation that transforms the users (Ibid.).

Hendricks et al. (2018) argue that the benefits of PDT are accountability, transparency and legitimacy in a government's response to residents' needs. It empowers people, bringing a sense of ownership, access to information and the power to challenge any misdemeanour that may occur. Kerkhof et al. (2019) describe the benefits of coupling experts such as researchers, developers and designers with users who can provide valuable input to the design. The collaboration resulting from user-participation can improve the application of the design and the environment in which the application will be used.

Schwittay and Braund (2019) ask whether ICT-enabled development can involve the meaningful participation of the users. The authors claim that in a useful ICT-enabled environment, the convergence between online activities and offline engagements (the use of old technology such as TV and radio) with new technology (such as IVRs and mobile technologies), does encourage participation among the users.

The multiple definitions of PDT provide a single attempt to unite local communities, stakeholders and interested parties around a specific task or goal, the purpose of which is to empower the beneficiaries. The outcome of these definitions

demonstrates a commitment to an outcome that “enhances both the quality and relevance of the suggested interventions” (Miettinen et al., 2016:5246).

3.4 The role of PDT

Cornwall (2003:1325) argues that participation has become a custom and a belief. The role of PDT has become prominent in the process of knowing the truth (Dearden & Haider Rizvi, 2008). The use of PDT has brought together marginalised voiceless citizens, or sections of the population, and influential famous citizens, in order to participate in discussions that lead to building the community (Barakabitze et al., 2017; Breuer & Groshek, 2017; Smith et al., 2017; Potter & Pugh, 2018). Chambers (1997:3) argue that “[t]he radical activist in a remote village in Bihar may not identify with the president of the World Bank; nor he with her. But we are all actors in the same ‘upper’ system of organization and communication which is ever better linked; our decisions and actions impinge on those in the “lower” system of rural and urban people and places. We are all trying to change things for others, we say for the better. We are development professionals.”

Cornwall (2003:270) describes the three typologies associated with PDT. The first topology demonstrates the progressive eight steps of participation, grouped into three categories that define the nature of participation (Figure 3.3). The lowest category is non-participation, represented by two steps: manipulation and therapy. The middle category is tokenism and is represented by three steps: placation, informing and consultation. The top category, that of the citizen’s power, and includes three steps: partnership, delegated authority and citizen control. The progressive eight steps of participation are historically known as Arnstein’s ladder (Arnstein, 1969).

The second typology was built on Pretty's (1995) original description of participation, which was refined in Pretty’s (1995:1252) paper, clarifying the different participatory approaches used when providing a service:

i) **Manipulative participation** occurs when unelected representatives with no power claim to represent the community. Participation under such circumstances is unreal.
ii) **Passive participation** is a top-down and unilateral approach to participation. People are passively listening to information delivered from the top structures or administrators.
iii) **Participation by consultation** is primarily an instruction from some authority, from the top office to the subordinates. People are told what to do, with little input from their side.

iv) **Participation for material incentives** provides incentives such as small amounts of cash, casual employment or food in exchange for labour, or to preserve technology donated by an external agent. The people have no part in prolonging technology.

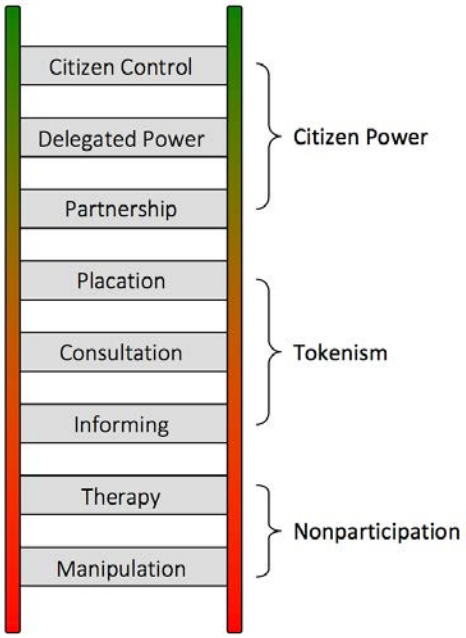

Figure 3.3: Arnstein's ladder of participation
(Source: Arnstein, 1969:217)

v) **Functional participation** means that decisions about significant contributions or projects are taken outside of the community. Community people are enlisted to ensure that the objectives of the project are met. In most cases, this approach has to do with a reduction of costs.

vi) **Interactive participation** involves community research that is concerned with projects that people need. The community takes control of their resources, maintaining and improving these resources in the process, seeking alternate views and multiple perspectives. The approach is systemic and structured. The community takes charge of its political destiny, determining how to allocate available resources.

vii) **Self-mobilisation** happens when the community mobilises, taking the initiative and not being coerced into action. The community establishes lateral linkages with organisations within the community, as well as vertical and external links that will ensure the success of the projects the community has selected.

The third typology adopts the historical White's (1996) typology of interests by defining four forms of participation, namely the nominal, instrumental, representative

and transformative forms of participation (Table 3.1). For each form, three tasks are highlighted to describe the interests of those engaged in participation. The first task defines participation in terms of the implementing agent, indicating the primary interest of those providing the service. The second task defines participation in terms of those who will receive the service. The third task is to explain explicitly 'participation' in terms of the desired effect on the process. Newton et al. (2019) used White's (1996) participatory approach to measure the empowerment of women and girls.

Table 3.1: A typology of interest
(Source: Cornwall, 2008:273)

Form	What participation means to the implementing agency?	What participation means for those on the receiving end?	What is participation for?
Nominal	Legitimation – to show they are doing something	Inclusion – to retain a degree of access to potential benefits	Display
Instrumental	Efficiency – to limit funders' input, draw on community contributions and make projects more cost-effective	Cost – of time spent on project-related labour and other activities	As a means of achieving cost-effectiveness and local facilities
Representative	Sustainability – to avoid creating dependency	Leverage – to influence the shape the project takes and its management	To give people a voice in determining their own development
Transformative	Empowerment – to enable people to make their own decisions, and to work out what to do and what action to take	Empowerment – to be able to decide and act for themselves	Both as a means and an end, a continuing dynamic

Cornwall's (2008) three typologies are useful tools to describe how each group within the community interacts within the realm of participation; how each group views their role; and the far-reaching influence that improves the quality of engagement. For example, Swapan (2016) uses Cornwall's (2008) approach in order to get a community to participate in community development's rational decision-making process. This affects social, political and psychological factors, rather than instituting small community organisational changes. Kamruzzaman and White (2018) established a relationship between empowerment, participation and development using Cornwall's approach. This relationship contributes to the process of historical change within the community.

Finally, the purpose of community interaction within the realm of participation determines the type of typology or engagement. Taking one aspect of the typology may produce unintended results. For example, delegated power can cause unnecessary tension for those who will be receiving feedback. The context and the

balancing of issues are essential to the facilitation of meaningful participation. For example, a balance of the elite, self-appointed community members and the members of the community delegated with the power to engage authorities is needed in order to manage the transferring and receiving of information carefully. All or most of the variables that encourage participation need careful consideration.

3.5 The principles of PDT

The previous section demonstrates that PDT could not be defined in a single, coherent and homogenous way. The definitions resulted in the formulation principles of participatory development. Keough's (1998:189) ten fundamental guiding principles are relevant to this research:

i) **Approach each situation with humility and respect**: Community members are the custodians of the vital information required for the development. Keough (1998) explains that humility and respect means recognition of skills and knowledge that the community members possess.

ii) **Understand the potential of local knowledge**: Local content and knowledge provide the building blocks for development. An understanding of the local people promotes the development of community projects that address the basic needs of people, such as poverty. However, in addition to those basic needs, abstract needs, including happiness, self-esteem and self-reliance, are addressed.

iii) **Adhere to democratic practice:** Power that is vested in local communities assists in breaking down barriers. The community should make and implement decisions. People should, of necessity, participate in making decisions that affect their lives.

iv) **Acknowledge diverse methods of knowing:** Communities have different knowledge systems, such as local, experiential, intuitive or indigenous knowledge. All these forms of knowledge are essential for the success of community-based development.

v) **Maintain a sustainable vision:** Keough (1998) argues that sustainable development, which gained momentum in the 1990s, provides a virtue that could assist with the development of a viable vision. When the community participates in making a decision that affects their well-being and is content with the developments, the concept of growth is sustained.

vi) **Put reality before theory:** While theory is vital to the development of reality, reality guides development. More attention should be placed on reality, with theory assisting in the construction of reality.

vii) **Enforce uncertainty:** PDT embraces the uncertainties of life as far as it is possible. Embracing good values such as reliability, commitment, honesty and morality provide the necessary ingredients to adapt in uncertain circumstances. Learning is a critical aspect to withstand uncertainty.

viii) **Recognise the relativity of time and efficiency:** Keough (1998) argues that human processes run in their own time and define their efficiency in a way that best fits them. PDT informs us about tensions that may arise and assists us to deal with them.

ix) **Consider a holistic approach:** PDT understands the complexity of human nature. A holistic approach to PDT with physical, intellectual, spiritual and social human beings in their environment gives space for interactions between power and unity, and, above all, fosters community development.

x) **Exercise an option for community:** Communities thrive in an environment where options exist. The power of choice engenders communities with self-confidence and trust. Communities are confident to deal with inconsistencies. The power to exercise options provides individuals with the self-belief necessary to improve lives.

Institutions such as non-governmental organisations (NGOs), local governments, and the World Bank have incorporated Keough's (1998) principles into PDT in order to address sustainable issues (Kapoor, 2002). Puri and Sahay (2007) demonstrate the role PDT in the implementation of ICTs, establishing district intranets in rural communities by analysing the development agenda. Hedelin et al. (2017:194) shown that PDT can be used as a tool to support a sustainable process that provides solutions for "wicked problems".

This study adopted PDT as the social-technical theory lens to help the researcher understand the interactions between the individuals, community and the government. In section 3.6, the researcher presents the reason why PDT was chosen as the theory underpinning this study.

3.6 PDT: The selected theoretical lens

The STS has numerous approaches to addressing the human condition. In this study, actor-network theory (ANT), activity theory (AT), structuration theory (ST) and critical social theory (CST) were chosen as examples of useful theoretical lenses. These theories are used extensively in IS social research. A summary of the social theories is provided in Appendix I. Avgerou (2013) argues that social theories are useful in IS research or in any research where humans are in involved.

IS research has embraced ANT (Callon, 1984; Latour, 1986; Law, 1992; Booth et al., 2016; Sheikh & Nyella, 2017; Elder-Vass, 2019). ANT regards all actors, human and non-human, as equal within a network (Appendix I). The ANT concept of a network between humans and non-humans having some form of fundamental structure can be a problem. Puri and Sahay (2007) argue that poor and marginalised individuals and communities shy away from their capabilities because of social and institutional structures. The result, therefore, is an unrealistic picture of power relations that renders the network ineffective. Booth et al. (2016) warn that within the network, actors' communication, power relations, modalities and structure can be misinterpreted. This study seeks to bring the rural and underserved communities in as partners with other actors who interact within the actor-network. ANT, as a theoretical lens, dilutes the participation, communication, power relations and dynamics of rural and underserved communities.

AT provides an analytical theoretical framework lens through which to describe human activities, using tools and artefacts within their context (Engeström, 1987; Engeström, 1999; Hashim & Jones, 2007; Bakhurst, 2009; Hasan et al., 2017; Kaptelinin & Nardi, 2018). Hashim and Jones (2007) argue that AT works well in the dynamic cultural-historical context where rapid and constant changes are the hallmark. Kaptelinin and Nardi (2018) contend that AT mediates between human beings and technology in order to respond to any possible contradictions. Iyamu and Shaanika (2019) highlight the difference between ANT and AT, pointing out that the human actor in AT defines the human roles in the activities within the social systems; while ANT concentrates on the network or relationships between actors. In this study, the historical and cultural context is required in order to understand the impact of community-based ICT projects on society. However, AT does not adequately address issues of sustainability and the scaling up participatory processes within communities. It does not sufficiently give a view of external activities that impact on internal activities to ensure sustainability.

MacKay and Tambeau (2013:676) argue that the central premise of ST recognises the notion that human action activity is at the centre of the social structure, over time and within a spatial context (Appendix I). The social structure is cultural and represents economic systems that are governed by rules and resources (Giddens, 1984). While these social structures predetermine agency, the individual agency can also modify or sustain such structures (Ibid.). A reflexive relationship therefore exists where the action is constrained and enabled by structure, but through reflexive feedback, structures are also changed by agency, often through the unintended consequences of the action (MacKay & Tambeau, 2013). ST is premised on human

action within a predefined social structure, which is defined by culture and economic activities. ST, therefore, addresses issues of the structure through recursive cycles. Wickramasinghe and Schaffer (2018) demonstrate how humans and non-humans could interact and contribute to a social healthcare system. In addition, Jeffries et al. (2017) propose the use of ST to examine how healthcare IT can be used in STS.

The problems facing rural and underserved communities are complex, requiring an in-depth analysis of the purpose of ICT within the community. While ST investigates and disentangles the complex interactions between human actors, technological artefacts and organisational structural features, ST falls short in providing an opportunity for analysis between the entities (Thi Pham, 2019). The need to understand the role and fitness of technological artefacts for deployment in the community is required. ST fails to identify the power and value found within the technology (Ibid.). As structures are understood, the rules, practices and routine over the time-space continuum, and the analytical power of existence, need a better understanding of understanding.

CST addresses social issues, such as the radical emancipation of societies (Appendix I). Klecun (2004) argues that CST does not prescribe how IS research should be conducted, but critically understands the social constraints through which ICT operates. While rural and underserved communities need radical emancipation from social ills, CST falls short in responding to probing questions on how emancipation can be achieved. Granter (2016) argues that CST is an appropriate way of providing a critical explanation of the work that needs to be done. Therefore, CST does not meet the requirements of this study.

3.7 The conceptual framework

Puri and Sahay (2007:142) define participation in IS development as follows (section 1.6):

i) *Who defines the participation agenda?* Because the developmental agenda may be externally driven, rural and underserved community participation may create challenges. The external sources may, from time to time, impose or dictate the agenda, which may not be suitable for the targeted rural community.

ii) *What is the capability of the people who participate?* Sen (1988:8) defines a person's capability as the ability to choose alternatives. The perceived description of the socio-political environment within the community affects the classification of capabilities. Limited knowledge, language barriers and

literacy levels contribute to what that capability is. Puri and Sahay (2007:142) cite five elements that should manifest in defining capability: (i) acceptance and responsible intrinsic motivation to participate; (ii) responsibility to act and account for the decisions take; (iii) access to resources necessary; (iv) freedom of communication; and (iv) the knowledge participants have about the problem domain. A conducive socio-political environment can create conditions that will attract participation from the community.

iii) *What is the role of institutional conditions in enabling effective participation*? Institutions can modify or create new community structures that may deviate from the historical context. Such changes should be implemented with absolute carefulness to implement.

iv) *How to sustain and scale-up participatory processes?* Integrating local efforts into more extensive networks of power and politics assist in addressing sustainable and upscaled local community projects. Local community design processes should grow beyond being localised, short-term projects so as to influence international communities.

Singh (2017) calls for community participation that will implement ICT initiatives as designs for sustained rural e-Governance projects. Singh further calls for the indigenous knowledge vested within these communities to be integrated into ICT initiatives. Hedelin et al. (2017) reflect on participation that generates commitment, legitimacy or acceptance. Participation handles structured communication, class, gender, or actor type.

Figure 3.4 summarises the use of the PDT framework as a lens through which to examine how the community-based ICT projects can be effective in building community relations and capabilities. The view through the PDT framework lens, associated with the integration of CI and EA, conceptualises the research the problem addressed in this study. The approach suggests a practical and pragmatic view of the problem. It is through the PDT lens that the empirical case of the role integration between CI and EA in rural and underserved communities will be discussed.

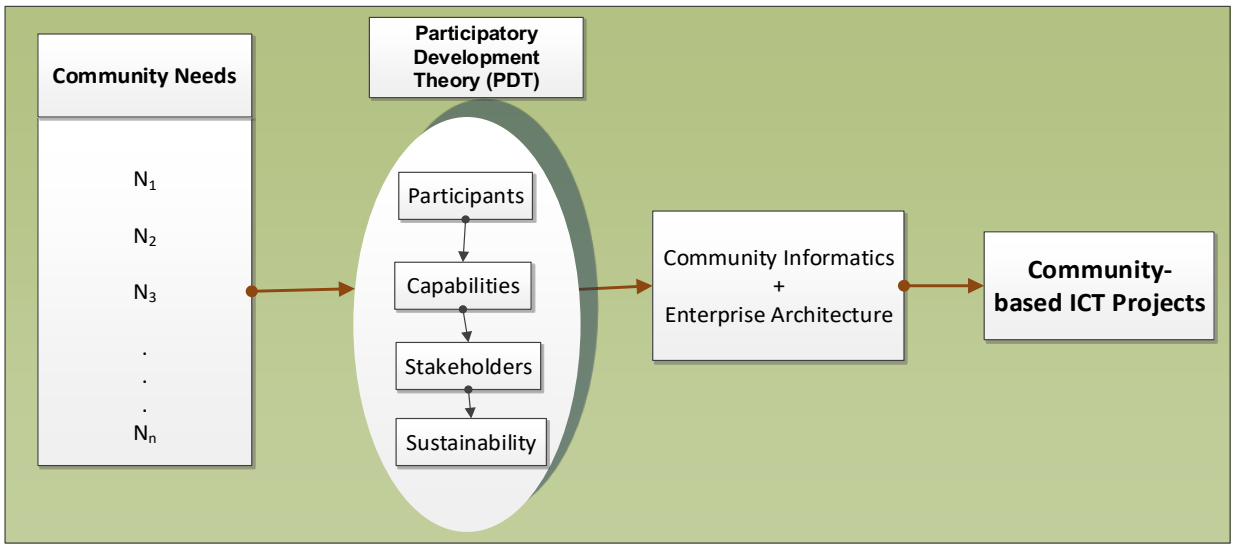

Figure 3.4: Problematisation of the problem

The conceptual framework provides a relationship between the key factors, constructs or variables (Miles & Huberman, 1994). The conceptual framework defines the relationship between different variables in the study. The established relationship leads to the specific direction of the research, exploring possible answers to the research questions.

In section 1.5, the researcher stated that the research aim was to explore the integration of CI and EA with community needs in order to build an EA4CD framework that will assist in developing, deploying and implementing community-based ICT projects. In this section, the conceptual framework takes into account the system of concepts, assumptions, expectations, beliefs and theories that support and inform this study. Figure 3.5 depicts the conceptual framework for the study.

The conceptual framework consists of the following:

i) CI;
ii) EA in government;
iii) the role of EA in CI;
iv) the role of CI in the ICT community needs;
v) the role EA in ICT community needs community-based ICT projects; and
vi) community-based ICT projects (the EA4CD framework).

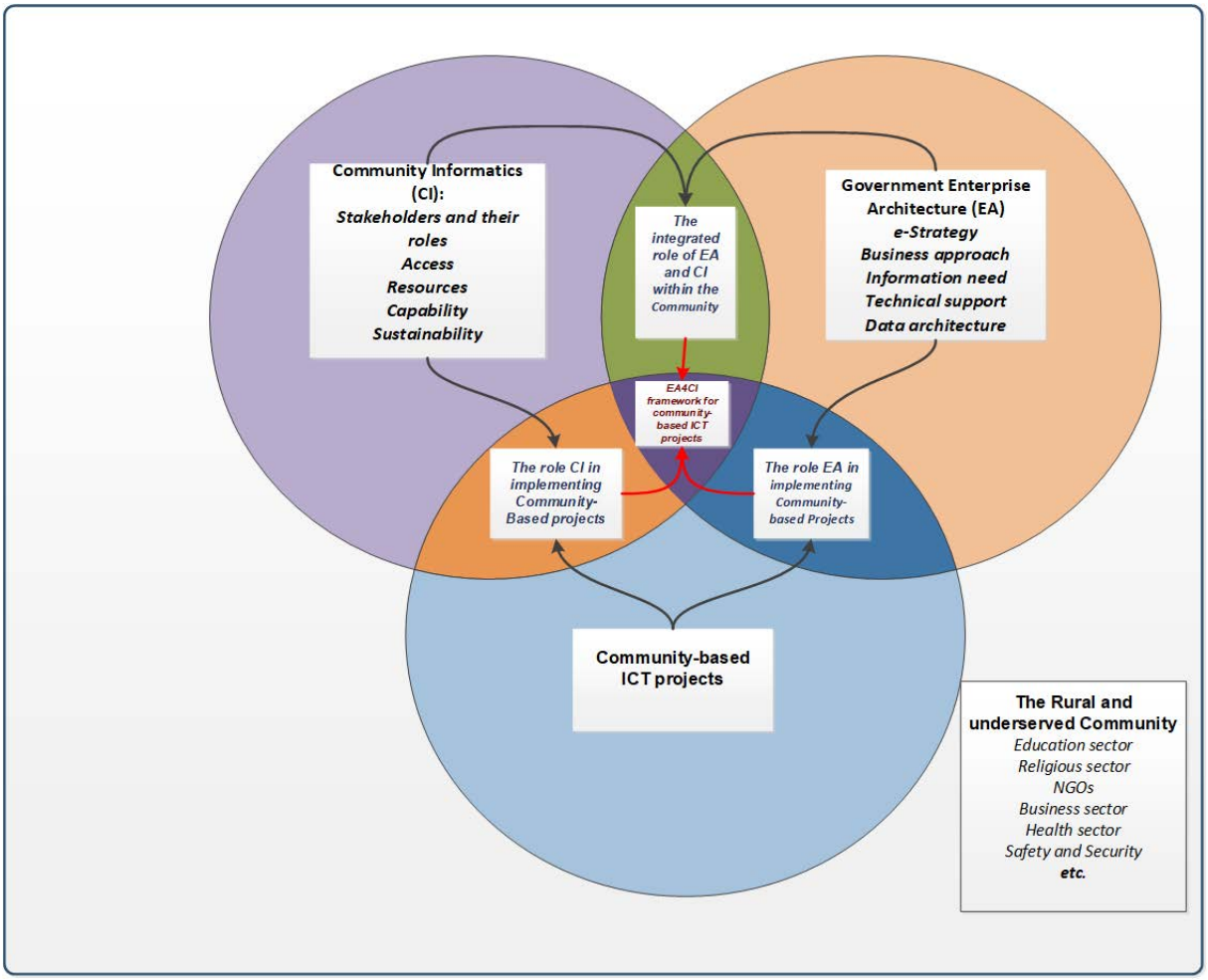

Figure 3.5: Conceptual framework

Community Needs: Once the central community is delimited, different sectors, smaller communities, neighbourhoods or virtual communities are identified. The purpose is to define the contribution that these sectors make towards instantiating the bigger picture. The education sector will specify community needs as they view them. Similarly, this is the case with the religious, NGO, business, health and safety, and security sectors.

The community of Grabouw represents a microcosm of the broader South African community, where the 'haves' and the 'have-nots' live side by side (Chapter Four). The context in which the community lives defines the acceptance or rejection of community-based ICT projects.

The following sectors were identified for this research to provide their views on the community's needs, education, religion, NGOs, business, health, and safety and security:

i) **CI:** In the literature review of Chapter Two, it is clear that CI emphasises sustainability, scalability, capability and evaluation as core concepts in its definition. CI seeks to drive development within communities. Communities should feel the penetrating influence of CI. The influence of CI drives the development, deployment and implementation of ICT projects in rural and underserved communities.

ii) **EA in government:** Local and national government, districts and municipalities provide the expert knowledge, resources and e-strategies required to define the basic structure of, and interactions within, rural and underserved community. In general, EA provides an opportunity to analyse the current "as is" state, which assists the government to provide ICT technologies which are relevant to the current demands. EA informs us of what is working or not working, and of the successes and shortcoming of current implementations. EA concepts assist in identifying the community EA concepts required to community-based projects. The local government's ICT strategy provides the necessary input for the design, deployment and implementation of community-based ICT projects. EA further provides an opportunity for the analysis of the *"to be"* state, which maps the landscape model; defining stakeholders' capabilities and the roles needed to establish an environment required to develop an EA4CD framework. This offers strategies and/or guidelines for designing ICT projects in rural and underserved communities.

iii) **The role of EA in CI:** EA concepts, together with CI tenets, provide additional value for community development. One of the strong points of EA lies in articulating the *"as is"* and *"to be"* states. The difference between the two states identifies the gap that exists between the current and the envisaged state. CI tenets viewed in the EA concepts, together with the 'to be' state, will assist in defining the community-based ICT framework.

iv) **The role of CI in the ICT community needs:** The intersection between CI principles and community needs defines the role of CI in choosing the ICT projects that respond to community needs. In applying CI principles, strong and weak points are identified within the context of the community's ICT needs.

v) **The role EA in the ICT community needs:** The intersection between government EA and ICT community needs defines the government EA role in setting-up IT technologies that encourages community development. Government EA can explain what the community ICT needs are.

vi) **Community-based ICT projects (the EA4CD framework):** Community-based ICT projects are at the heart of this study, providing the study's point of departure. The ambitions, aspirations or desires of the rural and underserved community drive the design of community-based ICT projects and the implementation thereof. The EA4CD framework defines how rural ICT infrastructure should support the community-based ICT projects in a manner that it has a positive impact on the community. The community members are not only the recipients of technology; they are also involved in the initial stages of choosing and implementing the right technology. The study defines the gap between the role of EA in implementing community-based projects and the role of CI in implementing community-based projects and the integrated role of government EA and CI within the community. The EA4CD framework addresses the said gap. Figure 3.6 illustrates the relationship between the conceptual framework and the research questions discussed in section 1.5.

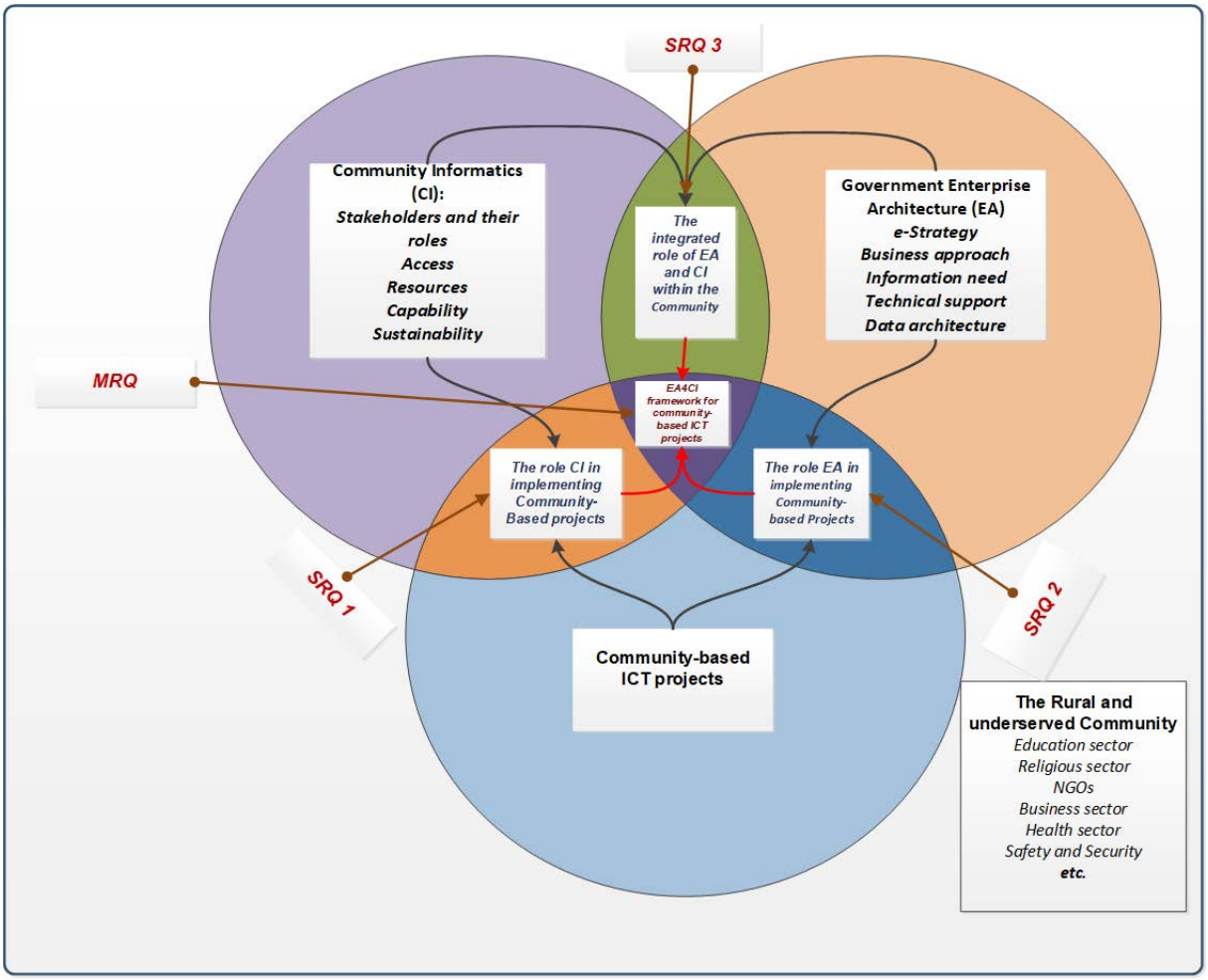

Figure 3.6: Conceptual framework with research questions
(Legends: SRQ = Sub-Research Question)

3.8 Summary

In this chapter, the researcher defined the social-theoretical lens of PDT, which underpinned this research. The historical evolution of PDT demonstrated the need for intellectual participation of humans in the community development activities that affect them. The researcher explained the role of participation and the ten guiding principles of participation. Other social theories mostly used in IS research were discussed to juxtapose these theories with PDT. This discussion supported the reasons why PDT was selected for this study. PDT allows for community participation as an input into ICT initiative designs, for sustained rural e-Governance projects. PDT further ensures that indigenous knowledge within the communities is integrated into the ICT initiatives. Finally, PDT builds commitment, legitimacy and acceptance. Participation deals with structured communication, taking into account class, gender and actor type.

In the discussion, the researcher further conceptualised the research problem by applying the PDT framework as a lens through which to examine how community-based ICT projects can be used effectively for community development.

Finally, in this chapter, the researcher defined the conceptual framework of the research, laying out a system of concepts that informed this research. Through the participatory theoretical lens and the conceptual framework, the researcher defined the natural setting of the case study and the field study location where observations and interactions with the community took place.

4. CHAPTER FOUR: GRABOUW CASE (FIELD STUDY)

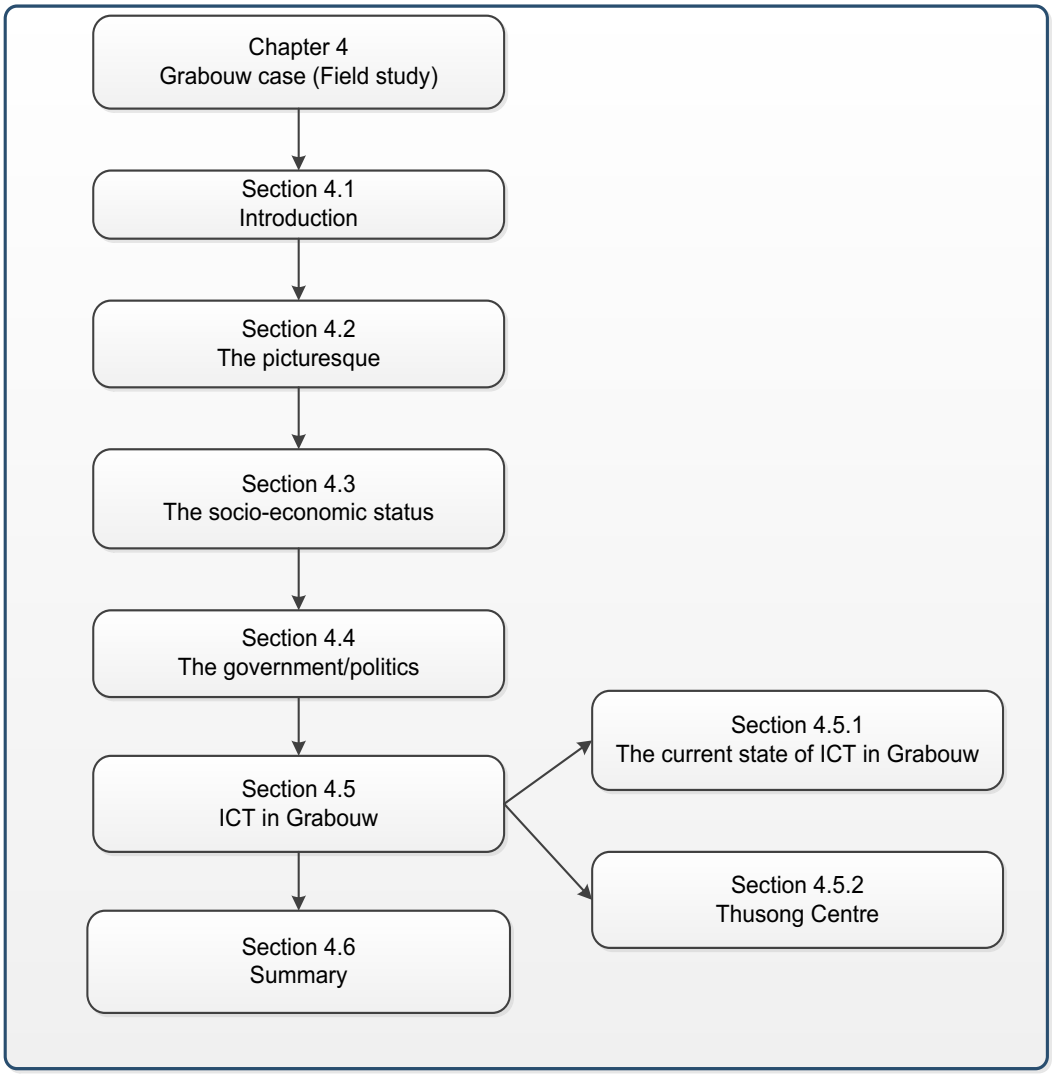

Figure 4.1: Chapter Four flow

4.1 Introduction

In the previous chapter, the researcher presented PDT as the lens through which community development can be viewed (Figure 3.1). By examining the community's needs through the PDT lens, a picture of the conceptualisation of the problem emerged. The conceptualisation picture, in turn, gave rise to the conceptual framework, which led to the mapping of the system of concepts necessary to address the research problem. The context of the framework needs further explanation. This chapter elaborates on Grabouw as a case study and a contextual field study. Grabouw community is typical of the most of the rural and underserved communities in SA. Firstly, they are geographically remote from the towns and cities. Secondly, level of care of community is either poorly administered or people have to walk for long distances, concerned about inadequate office hours. Thirdly,

there is a high cost of service deliver due to economies of scales. Finally, CPUT researchers have an acceptable repertoire in the area which makes possible to collect data.

The Grabouw community, as the unit of observation, is crucial to this study as the components of the EA4CD framework emanate from this locality (Figure 4.1). The government and the local community are the units of analysis, while the units of observation are the participants.

This chapter unveils the socio-political and economic landscape, which includes transport, health services, education and the NGO sector. Grabouw, as a rural and underserved community, is in a unique position in that poverty is situated within a thriving farming community. This understanding will assist in extrapolating and extending the lessons learnt to other similar rural and underserved communities in South Africa.

4.2 The picturesque landscape

Grabouw is a mid-sized town, which is situated on the N2 highway over Sir Lowry's Pass from Somerset West. It is about 70 kilometres (44 miles) southeast of the city of Cape Town (Figure 4.2), in the Western Cape Province of the Republic of South Africa (Figure 4.3).

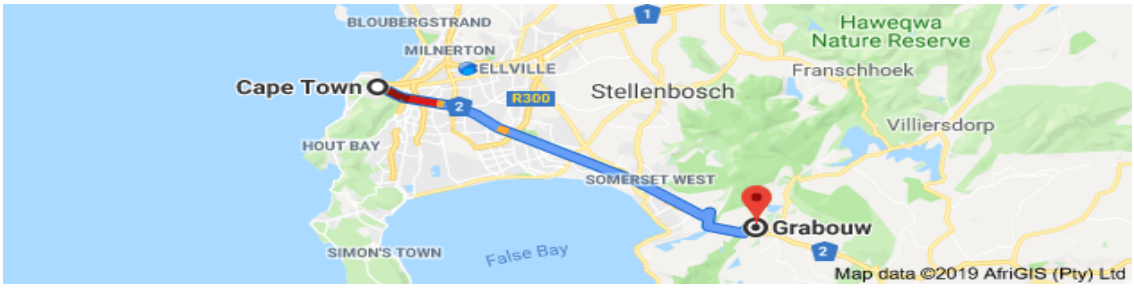

Figure 4.2: Distance between Cape Town and Grabouw
(Source: AfriGIS, 2019)

Figure 4.3: Western Cape in South Africa
(Source: Nations Online Project, 2019)

In 1856, Wilhelm Langschmidt, a trader who lived in Cape Town, bought a farm named Grietjiesgat. Langschmidt named the town Grabouw, after his German home village in Europe. The town of Grabouw is situated within the Theewaterskloof (TWK) Municipality, with the capital town, Caledon, 47 kilometres (29 miles) east of Grabouw. The TWK Municipality is classified as the rural municipality.

The town, nestled within Elgin Valley with the Palmiet River cutting through it, is surrounded by the Hottentots-Holland and Groenland (a Dutch name meaning Greenland) mountains to the north, and Kogelberg Biosphere Reserve to the south, providing a magnificence scenic splendour to this small mid-sized rural town.

Grabouw is one the eight towns that make up the TWK Local Municipality District. Grabouw's neighbouring towns are Botrivier, Caledon, Genadendal, Greyton, Riviersonderend, Tesselaarsdal and Villiersdorp (Figure 4.5). On the western side of TWK is the Elgin Valley with the Palmiet River cutting through it; on the northern side is the Sonderend River with the Theewaterskloof Dam; and on the south-eastern side is the Overberg plains with the Bot and Klein rivers.

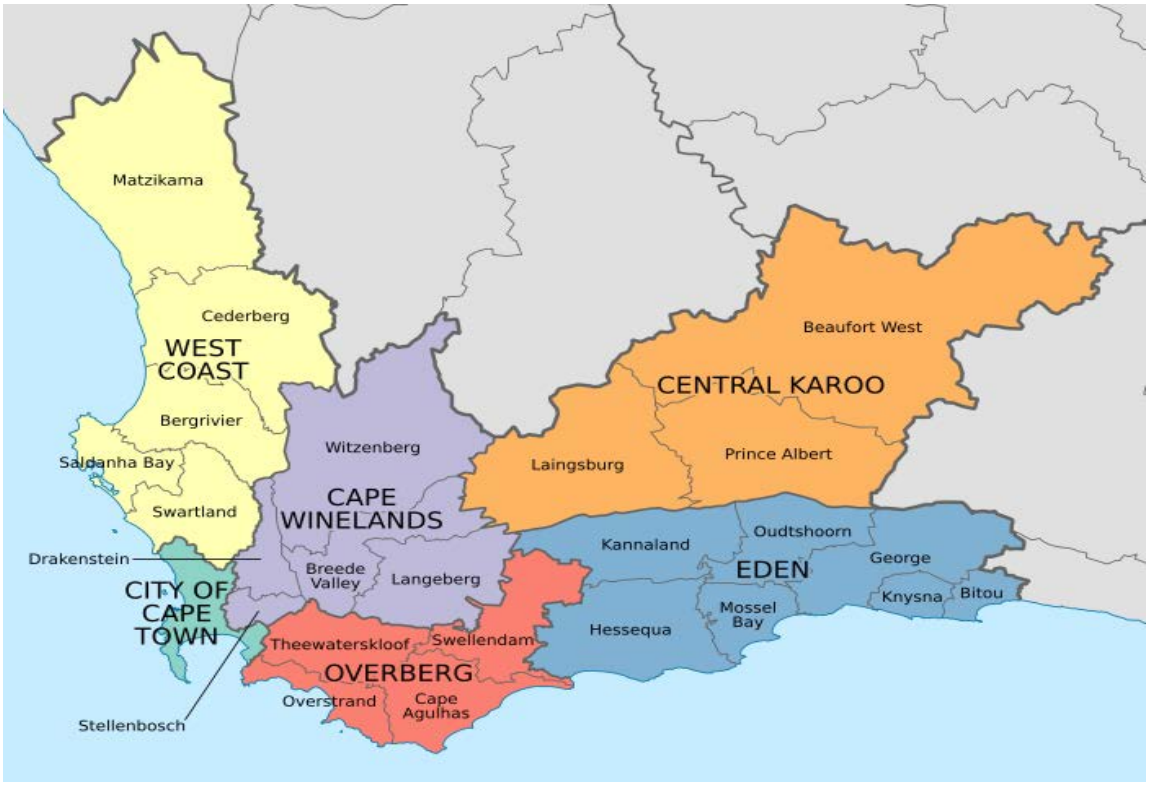

Figure 4.4: Overberg District (pink) within other districts in the Western Cape (Source: http://www.municipalities.co.za)

TWK is one of the four municipalities within the Overberg District (Figure 4.4 – pink). The Overberg District is one of six (6) districts in the Western Cape Province, including the City of Cape Town Metropolitan Municipality (Figure 4.5).

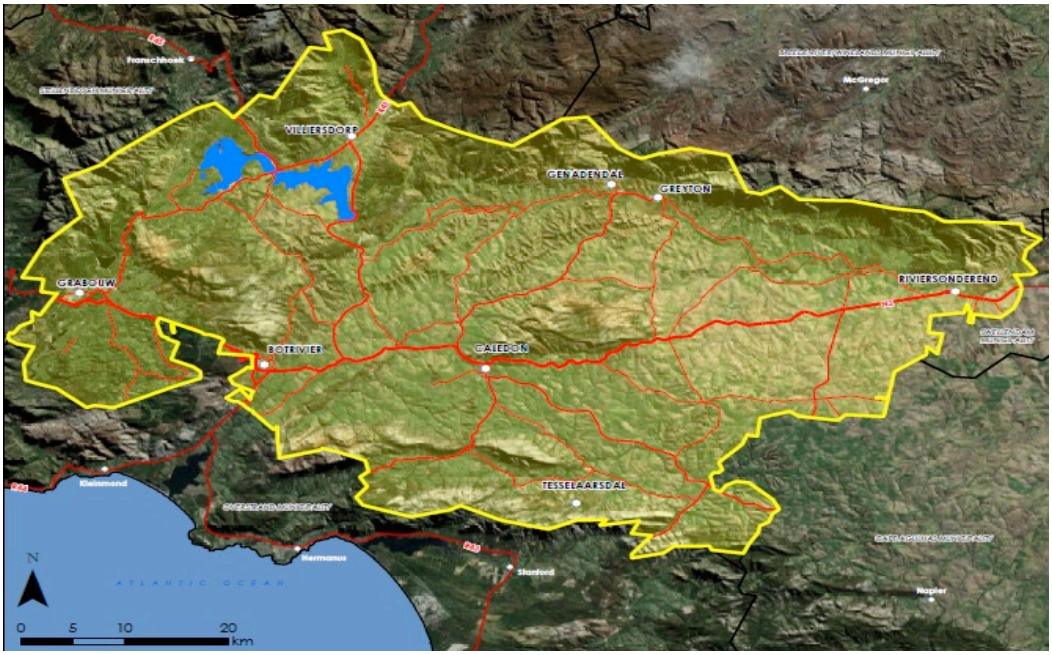

Figure 4.5: Theewaterskloof Municipality (Source: http://www.twk.org.za)

Grabouw forms part of the Elgin hilly valley floor, which boasts a Mediterranean climate with warm to hot, dry summers and mild to cool winters (with winter rainfall) (Figure 4.5).

4.3 The socio-economic status

According to the 2011 census[1], Grabouw has a population of 30 337 residing in 7 708 households. Grabouw has an almost equal ratio of males (49%) to females (51%). Afrikaans (62%), isiXhosa (29%), Sesotho (5%) and English (2%) are the four dominant languages spoken in the area. Other languages are spoken by 2% of the population. According to the Integrated Development Plan's (IDP) fourth-generation document (2017-2022), young people (less than 35 years old) are in the majority. According to a 2016 community survey[2], the TWK Municipality has an estimated population of 117 109 (108 790 according to the 2011 census), the highest number of people in a municipality within the Overberg District. TWK Municipality's population is expected to reach 125 505 by 2023, representing a 6.7% increase. Most economic activities within the TWK Municipality take place in Grabouw. This statistical growth makes Grabouw the most significant community within the TWK Municipality.

The TWK Municipality has vast tracts of rural land for farming activities. Grabouw's most substantial economic contributors are active in the agricultural sector, with the largest number of apple producers found in Groenland Valley. Grabouw has an advantageous economic and strategic position, situated, as it is, along the longest national route (about 2 300 km or 1 400 miles) in South Africa, namely, the N2, which stretches from Cape Town in the Western Cape, through Port Elizabeth and East London in the Eastern Cape, and through Durban in Kwa-Zulu Natal, to Ermelo in Mpumalanga. Grabouw is the main point of entry into the Cape Metropolitan region, the Overberg and the Southern Cape. Grabouw is a critical town in the TWK region, forming an economic hub that largely entails farming and tourism. The economic opportunities have attracted a vast number of employment seekers who could not always find employment, thereby stretching the resources in the area.

There are approximately 76 farms in the Elgin Valley (Van Zyl & Pennanen, 2013). Groenland, the most significant apple producers in South Africa, produces over 30% of the country's apples. Pear producers in the area are the second largest producers

[1] Statistic South Africa conducted the first post-apartheid census in 1996, which was followed by the 2001 census. The next census was scheduled for 2006, but its status was changed to a Community Survey because Statistics South Africa was not in a position to conduct a full-blown successful census; this was rescheduled for 2011, which did take place (http://www.statssa.gov.za/?page_id=3836). Another community survey was conducted in 2016.

[2] Community surveys provide statistics at municipality level to support planning and decision making.

of pears in South Africa. Agri-processing firms, such as Two-a-Day packing and marketing firms such as Appletisers, along with large farms, such as the Molteno Brothers, employ a large number of people. The grape industry in the Elgin Valley is famous for its production of wine and the soft drink, Appletiser. The Elgin Valley has about 18 wine farms. Because of all the farming activities in the area, tourism flourishes in the TWK region TWK.

According to NM and Associates Planners Designers (2013), the farming sector has remained stable, despite the fact that national and global trends have slowed down. The widespread drought during 2017 and 2018 in the Western Cape caused a decline in farming production, causing farmers to reduce their labour force. The net result was that poverty in the region increased.

In response to the socio-economic challenges, TWK values education and training. The IDP (2017) indicates that knowledge is a critical socio-economic right that will help young people acquire the necessary skills. Schools in the area also struggled to meet the essential requirements needed to run a proper school, for example, being without resources like a library. Given financial constraints of the parents, some children were not able to attend school or pay their school fees. Despite these challenges, schools have maintained a reasonable matric pass rate of 88% (IDP, 2017).

The lack of long-term employment due to the seasonal nature of the job market is a cause for concern. The influx of job seekers from other areas of the South Africa, and from Zimbabwe, Malawi and other African countries, increased the burden on resources, including housing. Informal settlements sprawled across open land, including areas that were earmarked for other development. Backyard dwellers increased the pressure on the already constrained service delivery initiatives provided by the TWK Municipality, which resulted in an increase in number of protests, with protesters demanding more houses and amenities. This placed enormous pressure on the municipality's financial resources. The IDP (2017) reported an unemployment rate of 40%. Twenty per cent (20%) of the household were said to be indigent. The housing backlog was reported at 8 500 units. Informal settlements increased in the following areas: Waterworks, Beverly Hills, Slang Park/Siteview, Hillside, Darkside, Zola, Marikana and Iraq. New informal settlements kept springing up, making it difficult for the TWK Municipality to address the issues.

People operating in the township economy employed a number of tactics, such as opening Spaza shops, selling firewood and establishing hairdressing businesses, to put food on the tables of people in informal settlements. The Western Cape

Provincial Government supports small, medium and micro-sized enterprises (SMMEs) as well as non-governmental organisation (NGOs) as initiatives to fight unemployment and reduce poverty.

The TWK Municipality has one district hospital, five fixed clinics, one community day-care centre and eleven mobile/satellite clinics, eight of which service the farming areas (IDP, 2017). There is a dire need for staff to take care of the high burden of a variety of diseases. TWK reports that the top three diseases that plague the area are HIV/AIDS, tuberculosis and inter-personal violence. Substance abuse, drugs and crime contribute towards the perpetuation of the top three diseases. Transport to access health facilities is often a challenge when one considers the low population densities, and the long distance between towns and the facilities (Figure 4.6).

Gaffley's Bus Service and the mini-bus taxis are the preferred forms of transport, but they cannot deal with the high volume of commuters. According to CNdV Africa Planning and Design CC (Overberg District Municipal, 2013), a multi-disciplinary practice focusing on urban design, environmental planning and landscape architecture, contracted by the Overberg Municipal District, claims that the distance from east to west, cutting through Grabouw, is about 7 km (4 miles). This makes it difficult for community members to move from one point to another without vehicle transport.

Figure 4.6: Grabouw's modes of transport

Religion in Grabouw provides essential support to residents in the surrounding community (IDP, 2017). Grabouw has several faith-based NGOs that address the needs of the community. People in need want to find comfort and peace in places of worship (Figure 4.6). Places of worship are open for community weddings. Priests and church members always offer support in times of need.

4.4 The governance/politics

The South African government has three spheres of government, namely national, provincial and the local municipalities. Each level has elected representatives, with political heads. National and provincial governments have departments headed by Ministers and Members of the Executive Council (MEC) who are political heads of departments. Municipalities have elected councillors who represent the needs of the communities.

The Overberg District's headquarters are in Bredasdorp. The TWK Municipality's headquarters are in Caledon, while the Premier of the Western Cape's offices are situated in Cape Town. Two spheres of governance are responsible for governing TWK, and comprise elected political heads, known as councillors, who are executors of council-meeting decisions. The African National Congress (ANC) and the Democratic Alliance (DA) are the two dominant political parties in this region.

4.5 The ICT landscape in Grabouw

In the this section, the researcher presents the current ICT landscape in Grabouw and in the Western Cape in general. The presentation focuses on the current ICT tools and services available in Grabouw, juxtaposed with what the WCG provides. Then, the presentation focuses on the Thusong Service Centre. Finally, the researcher cites challenges and opportunities for the Grabouw rural and underserved communities.

4.5.1 The ICT tools and services

Government documentations (Table 4.1) reveal that ICT tools and services in the South African government, WCG, Overberg district and TWK municipality, specifically in Grabouw rural and underserved communities are critical in implementing community development. The bifurcated (split) nature of Grabouw where the developed communities, developing, and undeveloped communities live as neighbours, provides reasons for ICT tools and services usage at personal level, government level and at national levels.

Table 4.1: Documents used in this research

Title	Year	Type of document	Source
Reporting on the assessment of the effectiveness of Thusong Service Centres in Integrated Service delivery	2010	The public service commission (RP: 60/2010)	
WCG Strategic ICT planning Framework	2013	Directorate: ICT planning framework	
National integrated ICT policy (White Paper)	2016	Department of telecommunications and postal services	
Socio-economic Profile: Theewaterskloof Municipality	2017	Government document	
Review of the Thusong Service Centre Service Delivery Model	2018	Departments of Public Service and Administration, and Communication and Digital Technologies, SA	Government Website
The state of ICT in South Africa	2018	Report	ResearchICTafrica.net
Strategic Plans 2020 - 2025	2020	Department of the Western Cape Premier (PR74/2020)	
The state of the ICT sector report in South Africa	2020	ICASA report	
WCG Strategic ICT planning framework	2020	Directorate: ICT planning and development (version 3.4)	

The government

The SA government is the critical partner in ensuring that ICT services and tools reach the remotest rural and underserved communities. The national department of Communication and Digital Technologies (DCDT) plays a leading role, across all the three spheres of government, ensuring that reliable ICT infrastructure exists to promote socio-economic development. DCDT views ICTs as mechanisms to facilitate the government's service delivery processes. Provinces do have some flexibility in deciding what to add to the national strategy in order to meet the local needs. The WCG leads its ICT strategy through the Centre for e-Innovation (Ce-I) in the Premier's office. The function is the passed on to the Overberg District who allocates the ICT functions to TKW municipality where Grabouw is based. The TWK ICT office is situated in Caledon.

The WCG, through its Centre for e-Innovation (Ce-I), identified three areas of ICT innovation within the province (WCG, n.d.). First, the provision of broadband to all districts and municipalities within the province. Second, the province-wide application of geographic information systems to collect and assess information to assist planning related to provincial spatial development and strategic infrastructure projects. Third, as a means to encourage government department's information-sharing strategies in order to enable an improved method of service delivery. Through Ce-I, the ICT sector has witnessed an accelerated growth of applications that support different types of data, voice and video services.

The Ce-I initiated a set of goals as a way of improving ICT deployment (the list is not exhaustive):

i) The **Cape Gateway:** This WCG provides access to information useful to citizens, such as traffic fines, social services, housing schemes and government budgets. The service aims to be user-friendly and to support the need for citizens to understand which part of government provides which service.
ii) The **Cape Access**: This WCG programme uses new and existing ICT infrastructure to provide rural communities with access to information technology. Libraries, local schools and multi-purpose centres are used as places where people can access ICT benefits. The Cape Access initiative brings together community leaders, NGOs, facility representatives and interested community members.
iii) **Free and opens source software (FOSS)**: The WCG developed policies that recognise the use of FOSS where viable and appropriate.
iv) **Provincial government enterprise architecture:** The WCG EA provides a framework for mapping out ICT infrastructure and applications use within the

provincial government departments. EA is thus used to integrate IT and government business.

Network readiness

The role players that provide network services in Grabouw are: Telkom SA, Mobile Telephone Network (MTN), and Cell-C. Telkom SA is a semi-privatised government enterprise providing fixed-line telephone services to the community, as well as the transmission of radio frequencies and the provision of value-added network services. Telkom SA offers mobile technology and wireless services. Vodacom, MTN and Cell-C are companies that offer mobile technology services to the area. A private Internet Service Provider (ISP), a company known as TWK Communications offer fibre connections, wireless Internet, Voice over Internet Protocol (VoIP) and network infrastructure.

The WCG is setting up a high-speed broadband where citizens in cities, towns and villages will have access to the government's ICT infrastructure (Overberg IDP, 2017:107). This initiatives cover schools, libraries and all public facilities.

The WCG is in the process of developing Wi-Fi hotspots around the province. The three high schools and the public library in Grabouw are already benefitting. Vodacom's 2G, 3G, 4G and 5G mobile network, MWEB, Telkom, and TWK Communications provide a suitable platform for the Grabouw community. The Internet penetration in the Western Cape has improved and now stands at 70%.

TWK municipalities view ICT as an enabler, influencing how things are done or as a driver, influencing change. ICT plays a crucial role in promoting socio-economic development. According to the IDP (2017), TWK Municipality, which Grabouw is part of, contributes 4% to the economy of Western Cape.

Grabouw Community and Personal ICT services and tools

The community living in Grabouw has several options to choose from, depending on the availability of resources. Data costs range from R600 to R800 per 20 megabits per second (Mbps) for a home fibre. The data costs charged by Vodacom, MTN and Cell-C vary from R100 to R150 per gigabyte (GB).

The community consumes data over the Internet for over-the-top (OTT) applications on social media, such as Skype, WhatsApp and Facebook. Some community members can afford electronic financial services such as Internet banking, and

electronic money transfers such as eWallet. The WCG has set up a Thusong Service Centre for use by community members who cannot afford data costs.

The government literature (Table 4.1) reveal that smartphones in rural and underserved communities are growing. Smartphones even surpasses the use of laptops and desktop computers. Fixed lines telephones are gradually becoming extinct. Two areas of usage are in social communication media and money transfers. Firstly, Smartphones are used for Facebook, Tweeter, WhatsApp, and Instagram. Secondly, Smartphones are used for mobile services, such as transfer and receiving money (Du Bois, Chigona & Garbutt, 2018).

The majority of migrant farm labourers in Grabouw regularly send money to their next of kin through electronic money transfers such as *'e-Wallet'* or '*InstantMoney*', '*SendImali*' and '*CashSend*' offered by major South African banks. Etim (2014) argue that Sub-Saharan mobile money transfers falls into two models: the additive and the transformative models. The additive model own bank accounts with the range of services such as checking banking balances, transfers between accounts, while the transformative model are users who do not own any bank accounts but will uses banking services to transfer money. The author argue that these people are a significant number. Grabouw residents use both models.

4.5.2 Thusong Service Centre (TSC)

The socio-economic status of people in the TWK Municipality requires a stable ICT infrastructure. The WCG introduced e-Centres through the implementation of Access programmes in rural communities. The purpose of these centres was to bring online government services to the people. There are currently approximately 70 e-Centres distributed across the rural communities of the Western Cape.

In 1996, the South African Government's Communication Task Group recommended the development of Multi-Purpose Community Centres (MPCC) aimed at expanding the use of ICTs and facilitating access to information in rural and underserved communities. The primary goal of the initiative was to provide every South African citizen with access to government services (Western Cape Provincial Government, 2017). This access to information was meant to drive development. The first compliment of these centres was known as "first generation" TSC, with 10 desktop computers, a printer and a dial-up internet connection. The purpose of this initiative was to implement communication infrastructure in support of development. Thusong is a Sotho word (one of the indigenous languages of South Africa), meaning 'to assist'. Establishment of these centres initiated because it

was crucial for rural and underserved communities to have access to Thusong Service Centres in order to fend away poverty.

The plan was to have one MPCC in each district by the end of 2004 (Western Cape Provincial Government, 2017). Currently, the Western Cape has about 20 TSCs. In 2004, the national government increased this target to one MPCC per municipality, which increased the number of MPCCs to close on 300. It was envisaged that metropolitan areas would have more than one centre. In 2006, the national government increased their mandate to provide government services. These services included the following:

i) The provision of identity and travel documents
ii) The issuing of birth, marriage and death certificates by the Department of Home Affairs
iii) The commissioning of repositories of information for youth development, bursaries and other community-relevant information
iv) A system for referrals and reporting substance abuse from the Department of Social Development, as well as all types of grants and registration of beneficiaries from the South Africa Social Security Agency (SASSA), a subsidiary of the Department of Social Development

Second generation centres include services such as vocational training, skills development, literacy, end-user computer classes and community gardens (Western Cape Provincial Government, 2017). Those involved in applying for jobs benefit from the use of these e-Centres. The difference between the first and second generation of MPCCs lies in the fact that first generation MPCCs only provided a limited range of government services.

Each TSC needed to comply with the following minimum standards (Review of TSC):

- Community must access government social and administrative services
- The minimum of six service models: office services; education and skills development services; local economic development services, business opportunities and services, and information and communications services.

The TSC in Grabouw opened its doors to the community on 1 October 2014 (Figure 4.7). There is a need for this centre in Grabouw, as Grabouw faces the challenge of high unemployment and the area is plagued with social ills. This centre is situated in the Gerald Wright Memorial Hall in the town. Residents commute to the centre

where they access services such as e-mail, the Internet and various government services. Residents can also communicate with government and with communities around the world.

In 2018, the two government departments, DCDT and the Department of Public and Service Administration (DPSA) revealed that TSCs had challenges.

Figure 4.7: Thusong Service Centre housed in the Gerald Wright Memorial Hall (Source: https://www.westerncape.gov.za/capeaccess/e-centres/overberg-district/grabouw-thusong/about-us)

4.5.3 ICT challenges and recommendations

The WCG government summaries the challenges facing TSC as follows:

- The cost of connecting is unsustainable, considering the weak outlook of the government's economic conditions.
- The lack of participation of the community in drafting the Integrated Development Plans (IDP), a super plan drafted by the local municipalities to build, co-ordinate and integrate the strategic plan for the municipality.
- The physical infrastructure and access to the TSC.

TSC's centre success rests on the partnership of the government and the community. The DCDT and DPSA recommends that a "multi-channel strategy" needs to be adopted. This strategy considers the advancing ICTs and mobile technology. The strategy should foster a collaboration between community stakeholders.

4.5.4 The development of EA4CD framework

SA rural and underserved communities are experiencing the triple challenge of poverty, inequality, and unemployment. Communities need to innovate in finding the best solution to address the current socio-economic challenges. Brandt (2006:57) advises that organisations and communities need well-defined frameworks that unite competencies and interests. The framework incubates solutions to social multi-dimensional problems. ICTs are strong contenders in ensuring the frameworks fulfil their purpose.

Researchers and practitioners fully exploit iCTs to promote community development. ICTs are not merely applying technological tools to facilitate work but are cognitive and generative tools. The use of ICT tools can assist in engineering to better understand the real-world problem-solving contexts. Boon and Van Baalen (2019) argue that ICTs need to cooperate and integrate relevant concepts into the cognitive order of analysis, synthesising, and evaluation. Kalandides (2018:152) encourages participation as a fundamental right in the institutional framework, participation as rights, participation in the public sphere, and participation as practice.

The development of the EA4CD framework through the integration of CI and EA is seen as a step forward in assisting the Grabouw rural and underserved communities in addressing SA's triple challenge. The field of CI, as Chen et al. (2018:1) describe, "focuses on how information and communication technology can contribute to the development and sustainability of local communities." In contrast, Seppänen et al. (2018:55) argue that government EA improves public electronic services quality and reaps the benefits of digital transformation. EA adoption is currently on the agenda of many public organisations and more so in the future.

4.6 Summary

Grabouw's economy is situated within the rural communities of the TWK Municipality. Farming is at the centre of the economy. Poverty surrounds wealthy farmers and, while the economic picture in the town looks good, poverty is rife in the neighbouring communities. This situation is not unique to Grabouw. Many prosperous industrial cities and towns in South Africa are surrounded by large settlements of the poor and underserved communities.

The community is underserved because it is made up of a large settlement of the poor people seeking seasonal jobs in the agriculture-related economy in Grabouw. The result of this inequality is that the development prospects of this community are hamstrung (Van Zyl & Pennanen, 2013). Grabouw does have ICT infrastructure provided by the WCG and by the private sector. However, the infrastructure requires

configuration in order to assist rural and underserved communities to access the sort of information that will be of help to them and to their own development. This will go a long way to improve the community's socio-political and economic situation.

The next chapter deals with the empirical research. In this chapter the researcher 'peels off' the layers of the Saunders et al.'s (2019) research onion by positioning the researcher's philosophical stance, explaining the approach to theory development, selecting the research methodology, and finding techniques and procedure to respond to the research questions stated in a previous chapter. In the discussion, the researcher introduces the DSR model that is responsible for designing the artefact. In addition, the abductive grounded theory process of data analysis used in the process of designing the artefact, is discussed. The research design process discussed in the next chapter provides a process to design the EA4CD framework required to address the problems experienced by rural and underserved communities.

5. CHAPTER FIVE: RESEARCH DESIGN

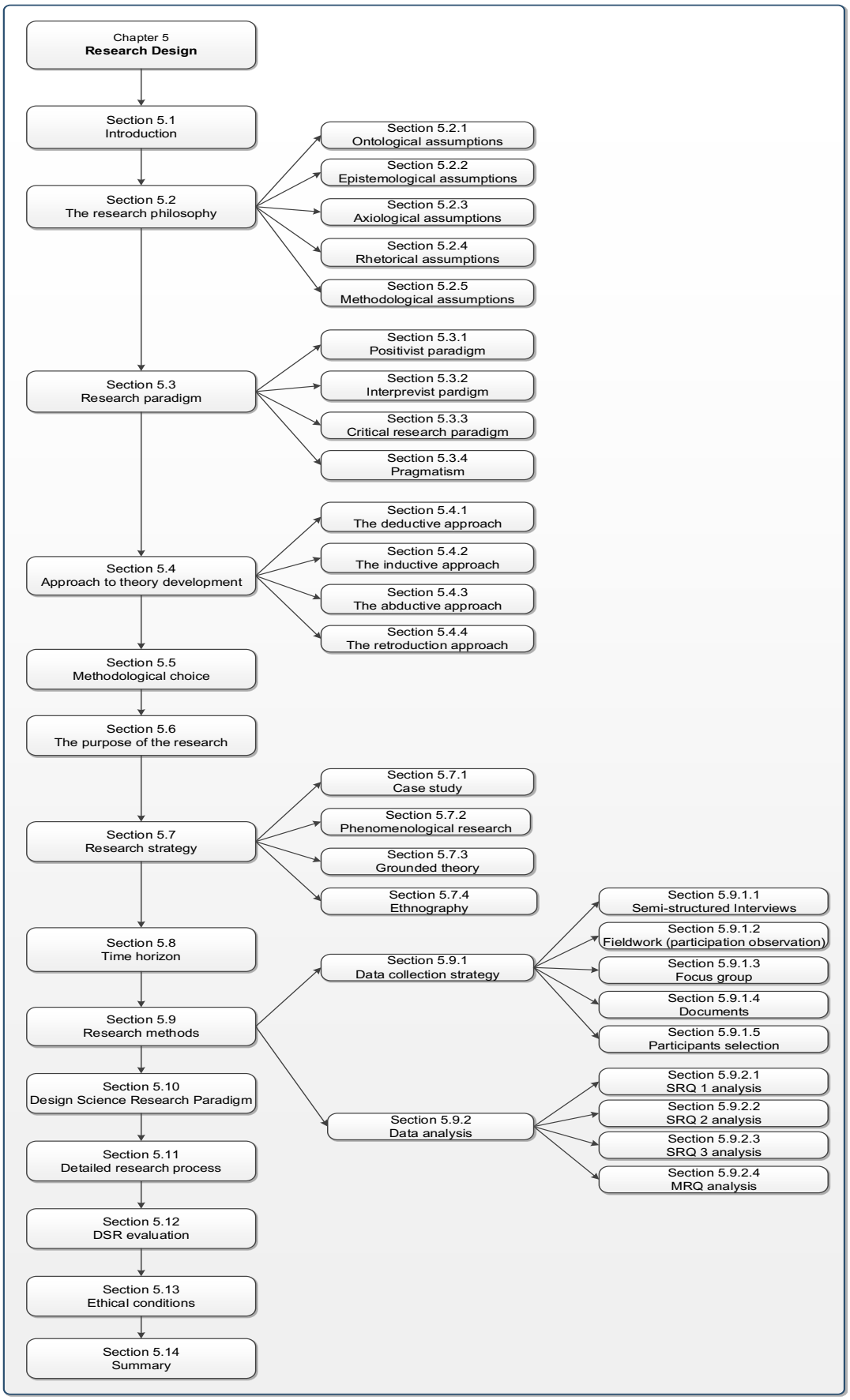

Figure 5.1: Chapter Five flow

5.1 Introduction

In the previous chapter, the researcher presented the case for Grabouw's selection as an area in which to undertake research with the purpose of understanding the role and relevance of the social context. In Chapter Five, the researcher presents the research design, which was set up as a comprehensive plan for the empirical research, and which aimed to answer the research questions posed in Chapter One in a logical and unambiguous manner (Figure 5.1).

The research design was selected with the intention to investigate the materials and resources mentioned in Chapter Four systematically in order to guide the research to reach conclusions. It is through research (as an action word) that the new experiences found in Grabouw are constantly sought, leading the study to sensible findings. Research design defines the logical structure of a research enquiry. The research design was used to set out the procedure for developing a design artefact, the EA4CD framework, which would guide the development, deployment and implementation of community-based ICT projects with a view to improve the living standards of people living in the rural and underserved communities. The research design in this study sought to foster a subjective and participatory approach to the collection, interpretation and analysis of data, and in so doing, answering the research questions. The study adopted Vaishnavi and Kuechler's (2015) DSR approach to design in order to develop and evaluate an EA4CD framework. The study adopted the interpretivist stance in order to fulfil this purpose.

The construction of the research design, against the backdrop of the research objectives, is presented as the peeling off of Saunders et al.'s (2019) six-layered research 'onion', as illustrated in Figure 5.2, in order to reach specific outcomes. The first outer layer of the research 'onion' represents the philosophical underpinning of the study (sections 5.2 & 5.3). In section 5.2, the researcher explains the broad philosophical stance taken, such as the ontological, epistemological, axiological, rhetorical and methodological assumptions made. In section 5.3, the researcher presents the research paradigms considered. The second layer of the research 'onion' deals with the approaches used towards theory development (section 5.4). The third layer of this 'onion' deals with the methodological choices made to conduct the study and the purpose of the research (sections 5.5 & 5.6, respectively). The fourth layer of the 'onion' reflects the chosen research strategy of the study (section 5.7). The fifth layer of the 'onion' deals with the time horizon of the study (section 5.8). The sixth and last layer of the 'research onion' (section 5.9), represents data collection techniques and procedures selected. In this section, the researcher further presents the data analysis undertaken by

applying the abductive grounded theory framework. In section 5.10, the researcher presents the relevance of DSR as an appropriate paradigm for this study. In this section, the researcher undertakes a general discussion of DSR literature, which supports the reasons for the selection of the paradigm in this study. In section 5.11, the researcher presents the detailed DSR research process used in the study. This is followed by an evaluation of DSR (section 5.12). Ethical considerations are discussed in section 5.13, and a summary of the research design is provided in section 5.14.

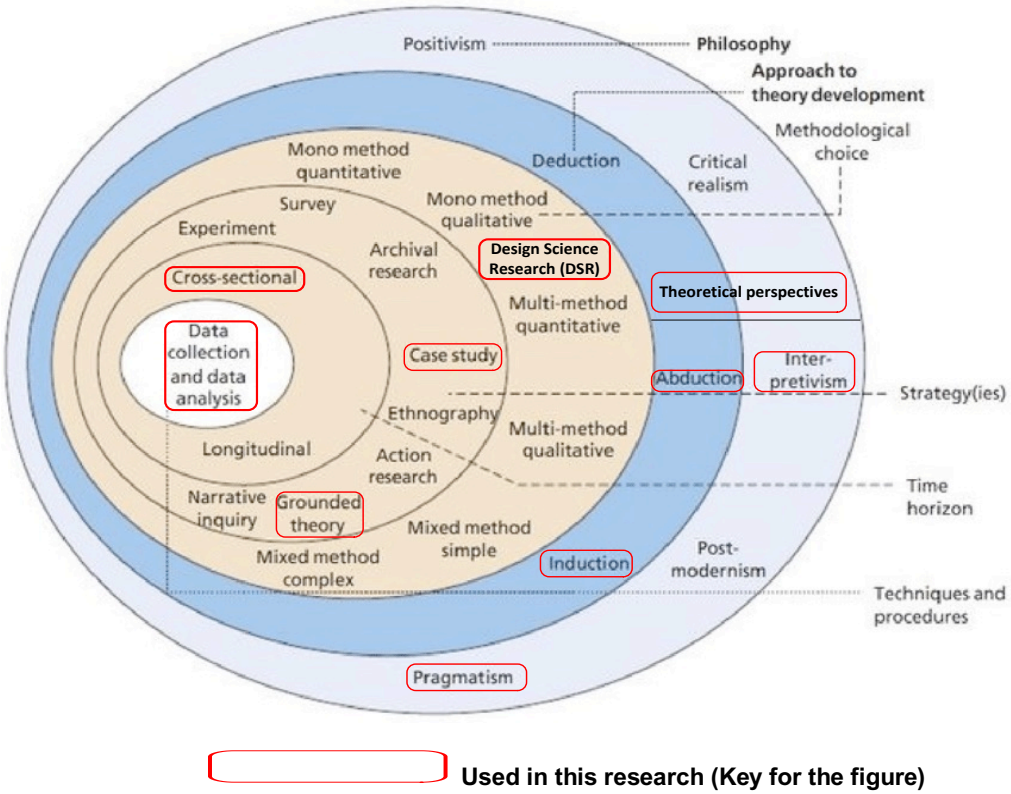

Figure 5.2: The 'research onion'
(Adapted from Saunders et al., 2019:130)

5.2 The philosophical assumptions

Research philosophy defines the underpinning reflected in the chosen principles of research paradigms (Mingers, 2003). Within the research paradigm, knowledge development forms an integral part of research, which formulates the generalised meaning of the things that are shared with the social world, where people's perspective differs from one another. Research philosophy aims to build human knowledge through a logically inter-connected system.

IS researchers provide philosophical assumptions that acknowledge their views on research. Generally, this set of philosophical assumptions assists the researcher to define the nature of reality or the worldview in which they operate. Clarity of the worldview helps to build research on sound theoretical foundations, and thus

articulates the research direction that the study takes. Knight (2010:5) posits that an individual or a group cannot make intelligent decisions without considering the proper philosophical assumptions of reality, truth, and values.

Philosophical assumptions are concerned with humankind's essential perspectives that grapple with reality, the nature of knowledge, the mind, matter, truth and logic abstraction (Uddin & Hamiduzzaman, 2009). The research philosophy allows the researcher to make claims about what knowledge is (ontology), how knowledge can be acquired (epistemology), what values go into knowledge (axiology), how knowledge is written (rhetoric) and the processes for studying knowledge (methodology) (Scotland, 2012).

5.2.1 Ontology

Ontology is a compound Greek term with *"on"* meaning 'being' and *"logia"* indicating a subject of study or interest (Smith, 2008). Ontology is, therefore, the study of being, in other words, what it means for something to exist, or the nature of being (Grenon & Smith, 2011). Ontology, as an interdisciplinary approach, combines science and philosophy (Corazzon, 2016). In science, the ontology defines the structure of the world through observation and experiment. In philosophy, ontology identifies and establishes the relationships between categories (Schiessl & Bräscher, 2017). Cua and Garrett (2009:37) state that ontological questions in IS should ask:

> "How is the phenomenon defined? How is the reality perceived? Who are the key stakeholders? What are the crucial components, that is, the change drivers, antecedents, stages, phases, decision points, consequences, of the process? How do these components interact with each other? What constitutes the process? How can it be differentiated from another process? Why and how do organisations undertake the process? What constitutes success or failure in the process?"

Knight (2010:8) suggests that ontology asks: "Is reality orderly and lawful in itself, or is it merely orderable by the human mind? Is it fixed and stable, or is change its central feature? Is this reality friendly, unfriendly, or neutral toward humanity?" The answers to these questions depend on the researcher's understanding of reality, affecting the way the phenomenon is defined.

The ontological debate, according to Barnes (2017), revolves around two polar opposite positions, namely, ontological realism versus ontological idealism. It is contended that the truth is objective, static and measurable (Killam, 2013). Killam (2013) argues that ontological realism converges with the truth, and is reductionist

and deterministic in approach. Smith and Ceusters (2010) state that ontological realism assumes that entities and processes composites are reducible to matter or material forces.

Ontological idealism, on the other hand searches for meaning rather than the truth. It is independent of the 'real world', perceiving reality as "a construct dependent on human consciousness" (Becker & Niehaves, 2007:203). For ontological idealism, the truth is subjective, dynamic and is affected by the change of time.

Becker and Niehaves (2007:203) advance a nuanced perspective on Kantianism, which argues that, "our minds force the world we perceive by distinguishing 'things in themselves' and the appearing of those things to an observer". Ritchie et al. (2013:5) further argue that the "subtle or collective idealism is about the social world made of representations constructed or shared by the people in particular contexts". This study took on the ontological idealism approach because it sought to construct the contextual social reality as shared by the rural and underserved communities. The reality is constructed through respondents' participation.

5.2.2 Epistemology

Epistemology derives from the Greek word *"epistêmê",* meaning 'knowledge', and *"logos",* meaning 'a subject of study or reasoning or argumentation' (Taule et al., 2005). The fundamental questions addressed in epistemology are: "How is knowledge acquired? How is knowledge created? How is knowledge modelled?" Reasoning or argumentation deals with the creation, modeling and dissemination of knowledge in order to address any possible scepticism. Epistemological assumptions seek to respond to questions of cognition and the object of cognition, as Becker and Niehaves (2007) argue, responding to questions regarding whether reality will ever be understood. Reasoning or argumentation analyses the nature of knowledge in order to accept it as truth, with reasonable beliefs and justifications (Hammersley, 2009; Howes, 2017). Ontological choice links to the epistemological stance (Creswell, 2013). The researcher's epistemological stance is that knowledge and meaning are derived as the result of interpretation of what the participants in research say. In the process of acquiring knowledge, the participants' point of view should take precedence.

5.2.3 Axiology

Researchers declare their value judgments from the onset, in other words, they declare whether their judgments are value-laden or value-free (Burrell & Morgan, 1979). Axiology considers the role of values, intuition and bias within the research

(Cresswell et al., 2013). Cultural experiences and upbringing regulate value-laden judgements, whereas value-free judgments are independent of data, thus maintaining an objective stance. Dudovskiy (2018) argues that the value-bound researcher holds a subjective attitude that cannot be detached from the research.

In the study, the researcher was subjected to a value-free, coupled with value-laden judgments. This stance was necessary for collecting field information, as it enabled interview freedom of expression and articulation. The challenges that rural and underserved communities face in community-based developments were better understood when the biases and prejudices of the researcher were set aside.

5.2.4 Rhetorical assumption

The fundamental question in rhetorical assumption is, “What is the language of research?” This question leads to the use of language as the art of persuasion. The type of study, whether it is ethnographic, grounded theory-based or a case study, lends itself to a particular style and structure of the research report (Creswell, 2007). No matter what the language structure, the qualitative researcher should report reality through the eyes of the researcher, without exaggerating or minimising the issues at hand. The third-person language used in this study emphasised the subject matter.

5.2.5 Research methodology

Kothari (2010:8) defines research methodology as “a way to systematically solve the research problem”. Research methodology provides a way of understanding how a scientific study of research is done. Methodology assumptions emphasise the philosophical stance that links methods used for the acquisition of knowledge to the outcome of the study.

The study avoided the objectivist philosophical stance of inquiry that explains reality and relationship between elements using universal laws; rather, the study sought to focus on how individuals or the communities create, modify and interpret reality (Creswell, 2013). Furthermore, the study encompassed research methodological approaches that gather, validate and analyse the data in order to craft an argument. The work plan for the study, discussed in later sections, was used to describe, explain or predict the framework of interest. The work plan brought to the fore the research methods, processes of data collection and data analysis, through which knowledge is constructed and, thus, avoided an arbitrary research conclusion.

5.3 Research paradigms

The IS research paradigm has indulged in several paradigms, albeit controversially at times (Rahi, 2017). Researchers are required to carefully select and define the paradigms underpinning their research from which they derive meaning. The researcher's choice of research questions, methodology and intentions were adequately orchestrated within a chosen paradigm, which resulted in articulating the investigated problems and what constitutes the answer (Grix, 2004:57). Kuhn's (1996:175) seminal book entitled, "The Structure of Scientific Revolutions", describes a paradigm as "the entire constellation of beliefs, values and techniques, and so on shared by the members of a community". Lincoln and Guba's (1994:17) original contributory definition of a paradigm is "a basic set of beliefs that guide the action". In qualitative research, paradigms vary with the set of beliefs they bring to the research and will mutate, evolve or become discarded, as time progresses (Kuhn, 1996). Individuals may also use multiple paradigms in their qualitative research that are compatible, such as constructionist and participatory paradigms (Creswell, 2007).

Since Kuhn's (1996) definition of paradigms, several permutations of paradigms have been postulated. All of these definitions of paradigms are important to the advancement of 'normal science', an activity that most scientists spend almost all their time investigating (Kuhn, 1996). For example, Chua (1986) lists three primary paradigm permutations: (i) positivism (and its various forms such as neo-functionalism, post-positivism); (ii) interpretivism (hermeneutics, phenomenology, and ethnomethodology); (iii) the critical paradigm (such as Marxism, critical social theory). Burrell and Morgan (1979) suggest four paradigms that define the social world: functionalism, interpretivism, radical structuralism and radical humanism. However, since the 20th century, positivism, interpretivism, critical research and DSR have emerged as historical and popular paradigms in IS research (Venable, 2006). Table 5.1 provides a summary of the fundamental differences between positivism, interpretivism, critical research and DSR paradigms.

5.3.1 Positivism

Positivism explains and predicts, and thereby discover necessary and sufficient conditions for any phenomenon (Mastin, 2009). To a positivist, knowledge is quantifiable, value-free and objectively determined. The researcher's objective stance is independent.

The research does not consider using positivism. The research aims at exploring the integration of CI and EA with purpose of building a EA4CD framework. The

framework cannot be objectively explained and predicted without a subjective socio-technical constructed reality emanating from multiple world states.

5.3.2 Critical research

Critical theory vigorously advanced social critique as a question to any social barriers or constraints that tend to inhibit society from enjoying the benefits of a better life (Klein & Myers, 1999:69). Social critique aims to emancipate humans from any form of slavery, giving back power, freedom and values to them (Rahi, 2017). Hence, the critical theory paradigm is also known as the advocacy or participatory paradigm (Ibid.).

Dé et al. (2018) argue that critical research complements ICT4D research. ICT4D research, just like critical research, vigorously examines the socio-economic values in developing countries. Both ICT4D and critical research are transformative. This study is not only about the social critique of the current status quo, but it goes further to develop, design, deploy and implement ICT strategies for the benefit of rural and underserved communities.

5.3.3 Interpretivism

Klein and Myers (1999:73) explain interpretivism as the dynamic relationship between people, organisations and technology. These relationships are not fixed; they are constantly changing. Ormston et al. (2014) argue that interpretivism relates to a philosophical position of idealism, which is used to group diverse approaches such as social constructivism, phenomenology and hermeneutics, together. Interpretivism rejects the notion of the objectivist view that meaning resides within the world independently of consciousness (McPhail & Lourie, 2017). In addition, interpretivism shares the belief that interpretation and observation in the social world are critical (Ibid.). Interpretation and observation should go beyond a common understanding, and it should stimulate ideas that have pragmatic with practical utility.

Interpretivism, as a scientific method, allows people and organisations to provide subjective information about their experiences. This is a significant claim in the context of this study because, in this study, the community's subjective views and the government's view provide the needed information to develop the designed artefact (i.e. the EA4CD framework).

5.3.4 Pragmatism

Plowright (2016:13) defines pragmatism as a method of inquiry with the objective to articulate clearly how an understanding of an idea or concept is reached through

practical investigations. Traditionally, the IS method of study was relegated to the dual meta-scientific paradigms, namely positivism and interpretivism. Goldkuhl (2012:2) argues that a third paradigm, pragmatism, brings to the fore “the action and change”, coupled with the interplay between “knowledge and action”.

IS research is associated with utility, efficiency and effectiveness (Hovorka, 2009). In the 1980s, research was dominated by cumulative theory-based research that enabled researchers to make prescriptions (Iivari, 2007). Between 2005 and 2007, IS researchers sought to validate and explore cause-effect relationships, aiming to discover the ‘truth’ using DSR. About a decade ago, DSR (section 5.10) came into existence as a pragmatic research paradigm (Hevner & Chatterjee, 2010; Hovorka, 2009; Winter, 2008; Iivari, 2007; Hevner et al., 2004). Weber (2010:4) argues that DSR is a pragmatic developmental paradigm necessary to provide “the systematic use of scientific knowledge” to build, evaluate and develop new technologies or prototypes. A developmental paradigm, which combines society and technology, is critical in research that involves rural and underserved communities. Moreover, pragmatic DSR (sections 5.10, 5.11 & 5.12) moves the process from the “*as is*” situation, considered as a problematic situation, to the “*to be*” situation, which is settled through an investigation made up of observation, evaluation, reasoning and intervention (Goldkuhl, 2012).

Grobler and de Villiers (2017) used pragmatic DSR to inquire about how the information needs of domestic women can be transformed into ICT in order to respond to these women's social needs. Baskerville, Bayere et al. (2018) extend DSR further from utility and the truth as well as synthetics and analytics to aesthetics. The aesthetic quality in DSR is found in the beauty of a successful implementation of the artefact.

5.4 Research approaches

In social sciences, human interactions and interpersonal relationships are crucial to ensuring community-based development. Reasoning can be a complicated process dealing with various individual thoughts and a variety of situations (Epley & Gilovich, 2016; Lee et al., 2016). A proper procedure should be adopted to reach an amicable conclusion. The result of cognitive reasoning establishes a belief system that informs actions (Reichertz, 2014).

Social scientists generally use four approaches as processes to make conjectures that will be “subjected to logical criticism and empirical testing” (Ngwenyama, 2014:9). The four inferential logic approaches commonly used in IS research are: (i)

induction; (ii) deduction; (iii) abduction; and (iv) retroduction. Table 5.2 summarises these four logical inferences.

5.4.1 The deductive approach

The deductive research approach builds on premises, which are general and universal to a specific statement. This type of reasoning is sometimes called the 'top-down' approach (Blaikie & Priest, 2019). The quantitative research's goal is to test theories or hypotheses by gathering descriptive information or examining relationships between variables (Ibid.). The deductive researcher's active role is to infer the logical implications of social rules to design observation. However, deduction cannot lead to new knowledge, theory or assumptions and does not specify sufficient conditions (Åsvoll, 2014:292). This study required the participation of the user, the community and the government. New insights were sought to discover ways of assisting the community in realising their dreams.

5.4.2 The inductive approach

The inductive approach, referred to as the 'bottom-up' approach, starts with observations of a particular phenomenon where data are collected, and moves up to make a claim or generate theory (Blaikie & Priest, 2019).

In qualitative research, induction generates statements based on observation in order to develop theory from empirical data obtained from interviews or from ethnographic data. However, the challenge with induction is that it is not possible to generalise conjunctions fully with a finite number of observations (Blaikie, 2018). Conclusions that emerge when using induction may easily be overturned.

5.4.3 The abductive approach

In a new or unknown situation, the abduction process is appropriate (Richardson & Kramer, 2006). Coffey and Atkinson (1996:155) argue that abductive logic is at the heart of grounded theory, where the data analysis process commences. Abductive research looks for patterns in an unusual phenomenon and suggests a plausible hypothesis. Abduction infers the best possible explanation (Wieringa, 2014). The interplay between the prediction of the outcomes, the description of the results and the explanation is often not enough. There may be other explanations to be assessed and considered.

Yu (1994:9) argues that abduction aligns well to exploratory data analysis. In exploratory data analysis, the researcher "observes the surprising facts, exploit[s] and check[s] the predicted values against the observed values". Abductive research,

therefore, explores for “the explanatory patterns” within the studied phenomenon (Åsvoll, 2014:291).

Table 5.1: Inferential logic approaches
(Source: Blaikie, 2007:8)

	Deductive	Inductive	Abductive	Retroductive
Aim	Test theories to eliminate false ones and corroborate the survivor	Establish universal generalisation to be used as a pattern of explanation	Describe and understand social life in terms of social actors’ motives, understanding	Discover underlying mechanisms to explain observed regularities
Start	Identify and explain the regularity	Accumulate data or observations	Discover everyday lay concepts, meanings and motives	Document and model a regularity
	Construct a theory and deduce hypotheses	Produce generalisations	Produce a technical account from lay accounts	Construct hypothetical model of a mechanism
Finish	Test hypotheses by matching them with data	Use these ‘laws’ as patterns to explain further observations	Develop theory and test it iteratively	Find a real mechanism for observation and/or experiment

5.4.4 The retroductive approach

Kovács and Spens (2005) believe that the main contributor to the term, Peirce et al. (1931), mistranslated the term ‘abduction’ to ‘retroduction’. As a result, some social researchers such as Richardson and Kramer (2006) do not differentiate between the two words. However, social scientists such as Ritchie et al. (2013), Ngwenyama (2014), and Blaikie (2018) distinguish between the two terms.

Blaikie (2007:89) argues that retroduction aims to discover the underlying mechanisms in order to explain the observed regularities. This means moving backwards across the domains from the empirical, via the actual, to the real, representing the way the domains are connected within active research.

Ngwenyama (2014:10) concludes the four logic of inquiry by providing a summary of the four logic inquiries. Deduction is about social rules needed to design testable observations. Induction infers general social rules from observed data. Abduction assists to categorise social phenomena or behaviour. Finally, retroduction infers causes and mechanisms underlying events or practice.

This study used abductive logic of inferences. The aim of the study was to explore how an EA4CD framework could integrate the tenets of CI with EA concepts in order to improve the development, deployment and implementation of community-based ICT projects. The study sought to make new sense of repeated observations and reasons why rural and underserved communities still do not benefit from community-based ICT projects. Abductive inferential logic provides a pragmatic approach to

inferring from observed facts, thus, giving explanations useful to describe the current phenomenon. Deductive reasoning lacks clarity in explaining how to select the theory to be tested. Inductive reasoning, on the other hand, cannot find empirical data for theory building and generalisation. Abductive reasoning, through a pragmatist perspective, provides the bridge between deductive and inductive logic.

Data are not an all or one essential commodity, but analysing and theorising lead to intellectual imagination of ideas parallel to the data management. The critical point is that existing theory can be useful in developing new ideas. Therefore, this study sought to refresh the argumentation by looking at the current intellectual theory, combined with data analysis to produce existing knowledge.

5.5 Methodological choice

Creswell (2013) cites qualitative, quantitative and mixed-methods research as three broad and commonly used methodological choices within the research process. It is within these three approaches that knowledge claims, such as post-positivism, constructionism, advocacy/participatory or pragmatism, research strategies and the research methods are explicitly articulated to clarify the procedure of enquiry.

Firstly, a quantitative approach has widely accepted usage among researchers who adopt knowledge claims, such as post-positivist, and who develop knowledge through cause and effect. The quantitative approach reduces data to variables, hypotheses and research questions through using specific research methodologies, such as experiments, surveys and collecting data with predetermined statistical instruments.

Secondly, a qualitative approach aims to understand a community, the organisation or an event by providing structure, order and broad patterns (Flick, 2019). Through observation and analysis, qualitative research is usually associated with the social constructivist paradigm (Kumar, 2019). Furthermore, through advocacy or participatory perspectives, politics and specific issues, collaboration knowledge is constructed.

With the third approach, researchers employ what is known as the mixed-methods approach, which integrates quantitative and qualitative processes in a single study. Through a mixed-method process, the research's diverse and expanded panoramic view provides several viewpoints.

Saunders et al. (2019) further propose expanded research methodologies that demonstrate how quantitative and qualitative techniques and procedures are

combined to formulate a research design (Figure 5.2). The mono-method approach utilises a single data collection method. The approach is either quantitative or qualitative methodology. The multiple method approach employs various combinations of data collection methods. Multi-methods use a broader selection of methods, while the mixed-methods approach is used to create a single dataset out of the combined methodology. The multi-method approach divides the research into two branches, namely, the multi-method quantitative studies or the multi-method qualitative studies (Saunders et al., 2019).

The qualitative nature of the research lends itself to a mono method research approach (Figure 5.3 – red boxes). The aim of the research is explorative and investigative, then the views and perceptions are sought to develop a framework that addresses the rural and underserved communities' needs.

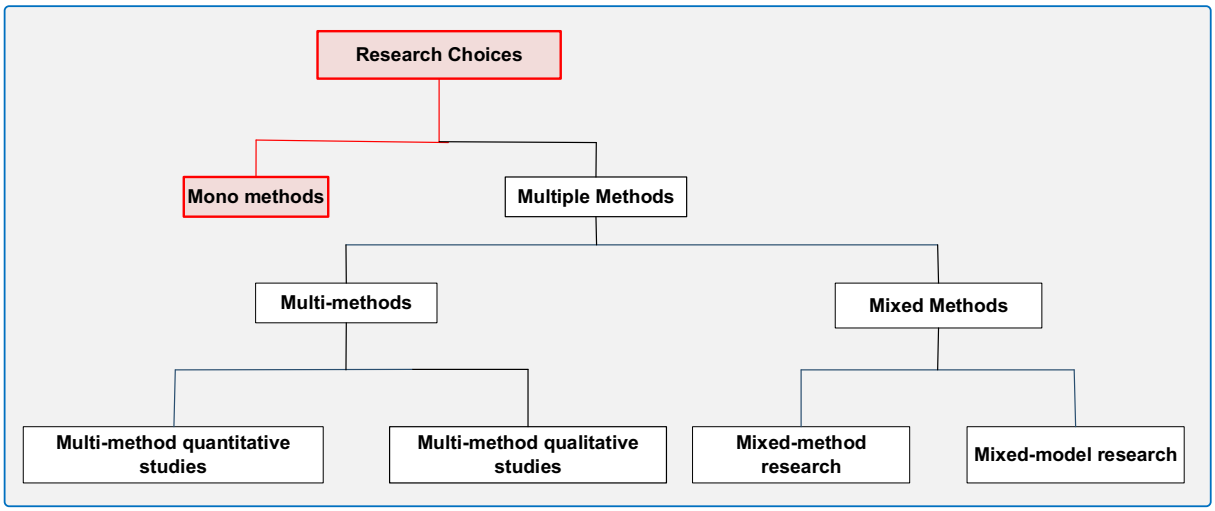

Figure 5.3: Research choices
(Source: Saunders et al., 2007:146)

5.6 Purpose of the research

The research purpose is generally classified into three categories, namely descriptive, explanatory and exploratory. The choice of selection is guided by the research questions and objectives of the research. It is possible to have a combination of two categories, such as descriptive and explanatory.

Descriptive research observes and describes the behaviour of a subject. The explanatory research purpose probes the causal relationships between variables to explain these relationships. In this study, explanatory research is used to answer the first sub-research research question (SRQ 1) in section 1.5.

The primary research question (PROQ) as well as SRQ 2 and SRQ 3 are exploratory because of the lack of research conducted in these areas (section 1.5).

The researcher explored the possibility of integrating two disciplines, EA and CI, in order to develop an EA4CD framework that assists with the implementation of community-based ICT projects. In Chapter Two, the researcher demonstrated the need to create EA4CD as a framework. Saunders et al. (2007:133) contend that there are three principal ways of conducting exploratory research: (i) a search of the literature; (ii) interviewing 'experts' in the subject; and (iii) conducting focus group interviews.

5.7 Research strategy

In the fourth layer, Saunders et al. (2019) cite several strategies that are useful in qualitative research. IS research provides a plethora of research strategies from which to select an appropriate research strategy. In essence, a research strategy offers the nuts and bolts of the application, describing the rationale for the research and the experiments which will be done to accomplish the aims of the study. This section defines and provides justifications for the selected research strategy. Dresch et al. (2014:154) suggest that the following factors influence the choice of the research strategy:

i) The objectives of the research.
ii) The form used by the methods to evaluate the results.
iii) The role of the researcher in conducting the activities.
iv) The potential for generalisation of knowledge.
v) The potential (although not mandatory) collaboration between the researcher and the requirement of an empirical basis for the study.

Although Saunders et al. (2019) present several research strategies, there are four predominantly used qualitative research strategies: a case study, phenomenology, ethnography and grounded theory (Creswell, 2013; Castleberry & Nolen, 2018; Mohajan, 2018).

5.7.1 Case study

Yin (2006:13) defines a case study as "a contemporary phenomenon within its real-life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context". Yin (2006) further posits that a case study is a research methodology that seeks a better understanding of current issues and usually complex phenomena in their real context. A case study, therefore, allows a miniature world to represent a real world that may be impossible to reproduce (Jaques, 2009). Case studies have three main goals, which are: (i) to describe a phenomenon; (ii) to test a theory; and (iii) to create a new theory (Løkke & Sørensen, 2014).

Dumez (2015) differentiates between a case and a case study. Case studies are methodologies, whereas a case has an isolated singularity and a narrative structure (Dumez, 2015).

A case answers three questions: (i) “What is my case a case of?” (ii) “What is the stuff that my case is made of?” and (iii) “What does my case do?” (Ibid., 2015:48).

Chapter Four describes the setting and the context of the case. The case in this study answered three questions. Firstly, the case of the Grabouw community categorised as both empirical and theoretical. The empirical category means that the case is an “instantiation of a class of phenomenon” (Ibid., 2015:48), whereas the theoretical category is the result of regulation by the theoretical framework. Secondly, the ‘stuff’ that makes the case refers to embedded cases that require investigation. The research questions regulate each case. Thirdly, a case allows the identification of a social mechanism. How are things done? The EA4CD framework looked into how a society could implement community-based ICT projects.

5.7.2 Phenomenological research

Phenomenology focuses on the accurate description, appearance or meaning of a phenomenon or thing as lived experiences of human beings (Hurssel, 2012). Johannesson and Perjons (2014:31) state that phenomenology “does not to establish cause and effect relationships, but describe[s] people’s experience” and, according to Sloan and Bowe (2014:1292), provides insights into the complex world.

DSR guided this study. It is discussed in the later section (5.10). However, some aspects of the principles of phenomenology focus on discovering and understanding the essential characteristics of a phenomenon.

5.7.3 Grounded theory (GT)

The early protagonists of the GT, Glaser and Strauss, believed that qualitative research suited the use of GT in order to close the gap between theory and the empirical world (Charmaz & Belgrave, in press). The researcher generated a meaningful theory from the systematically collected data, and thus merged the theoretical world with the empirical world, formulating a useful framework upon which to base the implementation of community-based ICT projects. In this study, SRQ 3 (section 6.4) adopted the abductive GT research strategy to respond to the empirical investigation of the integration of CI and EA. This strategy suits SRQ 3 as it attempts to bridge the gap between theory and the empirical study in order to explain the integration of CI and EA. The explanation of the abductive GT research method for SRQ 3 can be found in sub-section 5.9.2.

5.7.4 Ethnography

Ethnography is the situation where the researcher is immersed in cultural and social relations, studying the subject from the people's point of view. IS researchers have adopted the use of ethnographic strategies in their research (Orlikowski & Baroudi, 1991). Baskerville and Myers (2015) have demonstrated the depth of ethnography in IS. Among many other forms of ethnography, design ethnography (DE) is a generative, future-oriented design, which involves the researcher being actively engaged with the research. Both DSR and DE aim to intervene, solve problems, contribute new scientific knowledge and improve a social-technical situation (Baskerville & Myers, 2015:17). The researcher did not opt to go down the ethnographic route because of time constraints, but instead chose the DSR option.

5.8 Time horizon

The fifth layer of the research onion posits two time horizons for the study, namely, the cross-sectional and longitudinal time horizons. The cross-sectional time horizon represents a short period of time used to collect data, whereas the longitudinal time horizon represents a more extended period of time required to examine change and development. The time horizon selected is not dependent on a particular research approach or methodology (Saunders et al., 2019).

5.9 Research methods

The sixth and final layer of the research onion revolved around data collection and data analysis, i.e. the research method employed. Myers (2013:25) defines research method as a "strategy of inquiry… for finding empirical data about the world". Research methods bring to the fore processes of data collection and data analysis that are built on the researcher's philosophical assumptions, and through which knowledge will be gained. A wide variety of research methods is available, and the selection of research method depends on what the study entails, the context of the study and the components of the research design (Maxwell, 2013). Research methods deal with sources of information, the sampling of information and types of instruments used in collecting and analysing data. Qualitative and quantitative data analysis or the combination of both, determines which research methods are selected.

5.9.1 Data collection methods

Data collection is the gathering the data, analysed to produce information that answers relevant questions and thus evaluate outcomes. The selection of appropriate research methods depends on the goal. Collected data can be either qualitative or quantitative. Quantitative data collection methods and analysis, which

include questionnaires, are statistically analysed (Dudovskiy, 2018), while words, sounds, feeling, emotions, colours and other elements are interpreted.

This qualitative study employed data-collection methods applicable to interviews, fieldwork (participant observation), focus groups and document analysis. These data collection methods required responses from participants, which were used to construct the artefact designed to solve a class of problems.

5.9.1.1 Semi-structured Interviews

Face-to-face interviews bring the researcher close to the participants and help to establish a rapport with the interviewees. Interviews offer opportunities for the researcher to clarify ambiguous responses, even though, at times, it may seem impractical, time-consuming and expensive when large data samples are involved (Leedy & Ormrod, 2018).

In this study, a series of open-ended interviews, a focus group, documentation and fieldwork were the sources of the information used to address the research questions. These interviews lasted between 30 and 45 minutes per session.

The general format of the interview guide (Appendix G) followed the following pattern:

- The researcher was introduced to the participants as a research student
- The researcher gave a brief explanation of the research and the reasons for the interview
- Scientific terms such as ICT, EA and CI were explained and simplified in a manner that a rural and underserved community member might understand
- The researcher requested permission to record the interview
- The participant was guaranteed of confidentiality and anonymity with respect to their participation in the research, while the safekeeping of the recorded interview material was also guaranteed
- For ethical reasons, the participants were asked to sign a consent form
- The participant was asked to respond to the interview questions

The researcher was always alert to the potential of an intimidating environment and issues of language. The approach used by the researcher was to create a relaxed atmosphere so that the emotional wellbeing of the participants was taken care of, and that the unspoken responses were understood.

5.9.1.2 Fieldwork (participant observation)

The researcher attended formal meetings where community development issues were discussed. Attendance at these meeting provided the researcher with valuable insights into observing the aspirations and desires of the community. Participant observation, in this manner, allowed for a cordial atmosphere where ideas were freely expressed, without fear of intimidation.

Besides formal meetings, the researcher had an opportunity to walk the streets, exchanging greetings and pleasantries with community members. This approach considered the cultural environment, which made participants feel relaxed.

5.9.1.3 Focus group

A focus group was deliberately planned so that the researcher could meet with a few purposively selected participants with the purpose of obtaining useful and detailed information about personal and group feelings, perceptions and opinions. Carey and Asbury (2016) in their study reflected critically on how a focus group approach can provide a way of collecting data from respondents. Maguire and Delahunt (2017) used focus groups to gain a collective sense regarding an understanding of their course of study. In addition, Nyumba et al. (2018) used a purposively selected focus group to gain an in-depth response to conservation social science.

in this study, one focus group comprising ten members was used to probe the role of CI as a discipline within the rural and underserved community (SRQ 1, section 6.2). Interest was critical, and therefore random sampling would have rendered the process difficult to manage. The method used to select group members was convenience sampling. The reasons for this selection included the availability, age, gender, religion, education and proximity to the community of the participants. The focus group participants felt more comfortable and freer to talk within the group.

The opportunity to host this focus group arose after a formal stakeholders meeting. The focus group meeting followed the same procedure outlined earlier (section 5.9.1.1).

5.9.1.4 Documents

Documents of interest to the researcher were available in the form of agenda, notices, minutes of stakeholder forum meetings and the WCG and TWK website documents. Documentation also included a five-year Integrated Development Plan (IDP) which local governments developed, together with local or ward councillors, explaining the developmental needs of the municipality under consideration. The

notable fact was the dearth of government documents, specially addressing issues of EA.

5.9.1.5 Participant selection

The Gerald Wright Thusong Service Centre stakeholders meeting in Grabouw, under the leadership of municipal officials, provided a platform from which to launch the formal empirical study, which involved participant selection and data collection. Appointments for interviews were secured after the meeting.

Appointments for individual participants snowballed from the first selected participant. The purposive sampling of participants assisted in recruiting key participants for this research. Subsequent interviews of participants took place in different locations in the community. In the end, interviews with twenty-three individual participants, and a focus group composed of ten participants were concluded. The selection of participants was purposively done, together with the snowballing technique, in order to reach out to more potential participants (Etikan, 2016). The selection of participants continued until the saturation point was reached. Saturation point was reached when the answers to the interview questions provided the same ideas and themes.

Table 5.2: Demography of participants

Participant #	Age*	Gender	Community Position
1	Youth	Female	Former unemployed Groenenberg
2	Adult	Male	Ward Councillor (Ward 12)
3	Youth	Female	Unemployed youth
4	Adult	Male	Business man
5	Adult	Female	Business woman
6	Adult	Female	Manager Youth Centre
7	Adult	Female	NGO
8	Young adult	Male	Community employed
9	Senior Adult	Male	Principal of a school
10	Adult	Male	Educator of a school
11	Young Adult	Male	Thusong e-Centre Manager
12	Adult	Female	Adult employed community
13	Young Adult	Male	Small business
14	Senior Adult	Male	Community church official
15	Adult	Female	Community unemployed
16	Young Adult	Male	Community seasonal worker
17	Senior Adult	Female	Community senior citizen

Participant #	Age*	Gender	Community Position
18	Adult	Male	Policeman
19	Adult	Male	WCG official
20	Senior Adult	Male	WCG official
21	Adult	Male	WCG official
22	Adult	Male	Overberg district official
23	Senior Adult	Male	Academic
24	Adult	Male	Educator
25	Senior Adult	Male	Reverend
26	Adult	Male	e-Centre staff
27	Adult	Female	NGO official
28	Adult	Female	Small business (Hair saloon)
29	Adult	Female	Unemployed school leaver
30	Adult	Female	Health Officer
31	Adult	Male	Councillor
32	Adult	Female	TWK Sustainable Officer
33	Adult	Male	Safety and Security Officer

*Age is estimated: Youth: 18-24; Young adults: 25-35; Adults: 36-50; Senior Adult: 51+

5.9.2 Data analysis

Data analysis, in general, is the process of evaluating data in an analytical and logical manner in order to answer to the research questions. According to Smit (2002:66), qualitative data analysis "is an ongoing, emerging and iterative or non-linear process". The following stages of data analysis are identified: editing of raw data, coding, theory development and construction of meaning (Figure 5.4).

Open coding looks for concepts or themes, defining and developing categories based on properties found in the data (Charmaz & Belgrave, 2015). Open coding is the creation of descriptive words or 'codes' representing a concept. *In vivo* codes are words used by the interviewees and the general codes, which the researcher selected. The researcher used both open coding and *in vivo* coding.

The next level of coding is axial coding. Axial coding is the process of identifying and grouping related codes. From the grouping of axial codes, selective codes lead to the analysis of a theme. Rahmani and Leifels (2018) call this process the emergence of theoretical themes.

Friese (2019) proposes a non-linear, recursive process of noticing, collection and thinking (NCT) for identifying codes. The noticing stage takes place when transcripts, observations and notes are read, assigning codes to observed patterns.

The next principle of collection is categorising the observed patterns into meaningful groups. The third principle of noticing explains and analyses the observed pattern, making generalised conclusions. Using ATLAS.ti in successive rounds of repetitions and iterations, thematic analysis involving interview analysis, literature analysis and validity and verification, the researcher was guided the research to new and 'surprising' knowledge. The thematic analysis used in this study worked with data, coming close to the tenets of GT, adding some significance to emerging themes. The brown back loop in Figure 5.5 represents a refinement of interview protocols so that emerging issues are included in the next set of interviews and observations (Ibid.).

Vaismoradi et al. (2016:103) emphasise that researchers need "to return repeatedly to data and the coding process throughout the analysis process". The approach brings together the researcher and the participants in order to generate new theory. Thematic analysis (TA) is used to identify patterns, generate themes and interpret datasets to create new theory (Maguire & Delahunt, 2017:3552). Braun et al. (2019:58) categorise the usage of TA in three streams: (i) theory-driven data coding and analysis (inductive versus deductive); (ii) an experiential versus critical orientation to data; and (iii) essentialist versus constructionist. Braun et al. (2019:844) view TA as an umbrella term under which there are three distinct areas, namely "coding reliability", "codebook" and "reflexive TA".

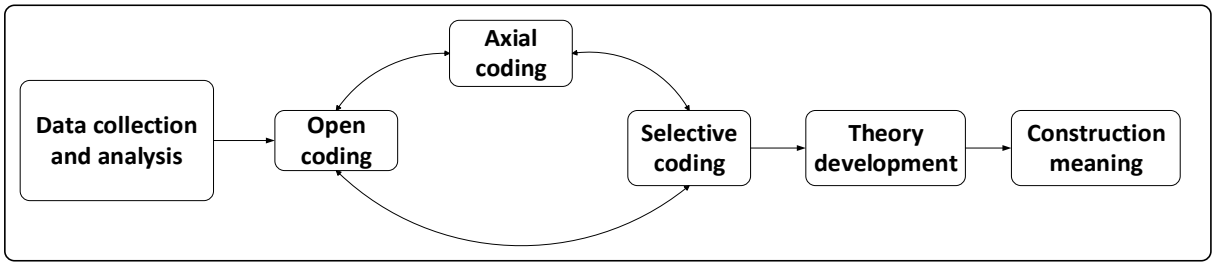

Figure 5.4: Non-linear process: Qualitative research
(Source: Williams & Moser, 2019)

Coding reliability ensures that codes are correct, reliable and accurate, representing the collected data set. The codebook contains the list of codes where the researcher categorises data into predetermined themes. The reflexive thematic analysis (TA) produces themes that result from coding.

Thematic analyses are not limited to the types mentioned above. Peterson (2017:6-9) has his nuanced list of TAs, such as the grounded theory and the constant comparative method, the Owen method, qualitative data analysis, narrative analysis,

discourse analysis, explorative data analysis, and content analysis. The researcher's choice of thematic analysis is representative of grounded theory.

In the next section, the researcher describes how the analyses approaches were chosen to answer the research questions.

5.9.2.1 SRQ 1 analysis

The objective of SRQ 1 (section 1.4.3) was to examine the reasons why rural and underserved communities are not benefiting from CI when implementing community-based ICT projects. Braun and Clarke's (2006) seminal article describes a comprehensive reflexive TA six-phase process (Table 5.4) to better reflect on the dataset provided by individual participants of a community in order to produce themes. Eighteen individual participants were interviewed in order to understand the community's ICT needs. The emerging themes provided an understanding of the ICT needs of the community. The community ICT needs, together with data collected from the focus group, provided themes that defined the role of CI in developing the community.

Table 5.3: Phases of thematic analysis
(Source: Braun & Clarke, 2006:87)

Phase	Description of the process
Familiarising yourself with your data	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas
Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code
Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme
Reviewing themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis
Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme
Producing the report	The final opportunity for analysis – selection of vivid, compelling extract examples, final analysis of selected extracts, relating back to the research question and literature, producing a scholarly report of the analysis

5.9.2.2 SRQ 2 analysis

SRQ 2 was answered using exploratory data analysis (EDA). The original proponent of EDA, Tukey (1980), defines EDA as a flexible attitude towards an understanding of unfamiliar but transparent phenomena. EDA aims to support an in-depth analysis of data in order to find patterns and themes in an unfamiliar context, rather than

focusing on the accuracy of results (Fallmyr & Bygstad, 2014; Komorowski et al., 2016).

The aim of SRQ 2 was to determine the government's EA role in implementing community-based ICT projects in rural and underserved communities. This context was unfamiliar in that EA had not previously targeted rural and underserved communities. Five experts were interviewed to determine the role of government EA in rural and underserved communities. The EDA procedure followed in section 6.3.1 was used to: (i) become familiar with data, (ii) revisit the research objective, (iii) develop a framework for findings; and (iv) identify themes.

5.9.2.3 SRQ 3 analysis

SRQ 3 was answered using Rahmani and Leifels's (2018) and Rambaree's (2018) abductive grounded theory data analysis processes, backed up by the ATLAS.ti tool as mentioned in sub-section 5.9.2. Rahmani and Leifels's (2018) process begins with the first dotted circle, which is called the "sensitising concept" (Figure 5.5).

This is an iterative process of investigating research questions, backed up by the literature review. This review is a necessary step towards providing direction for the formulation of the initial interview questions. In this study, the "sensitising concept" took place in phase 1, covered in chapters One to Four of the DSR research strategy. The problem statement leading to research questions was formulated in Chapter One. The SLR was presented in Chapter Two, where the research questions were reviewed. Iteration between the literature review and research questions followed, resulting in refined research questions. In Chapter Three, the theoretical and conceptual frameworks were introduced, further "sensitising" the research questions. The field of study was introduced in Chapter Four, which made an indirect contribution to the refinement of the research questions.

The arrow in between the sensitising concept circle (red circle) and the data collection and microanalysis (blue dotted circle) represents the formulation and refinement of interview questions (Ibid.) (Figure 5.5).

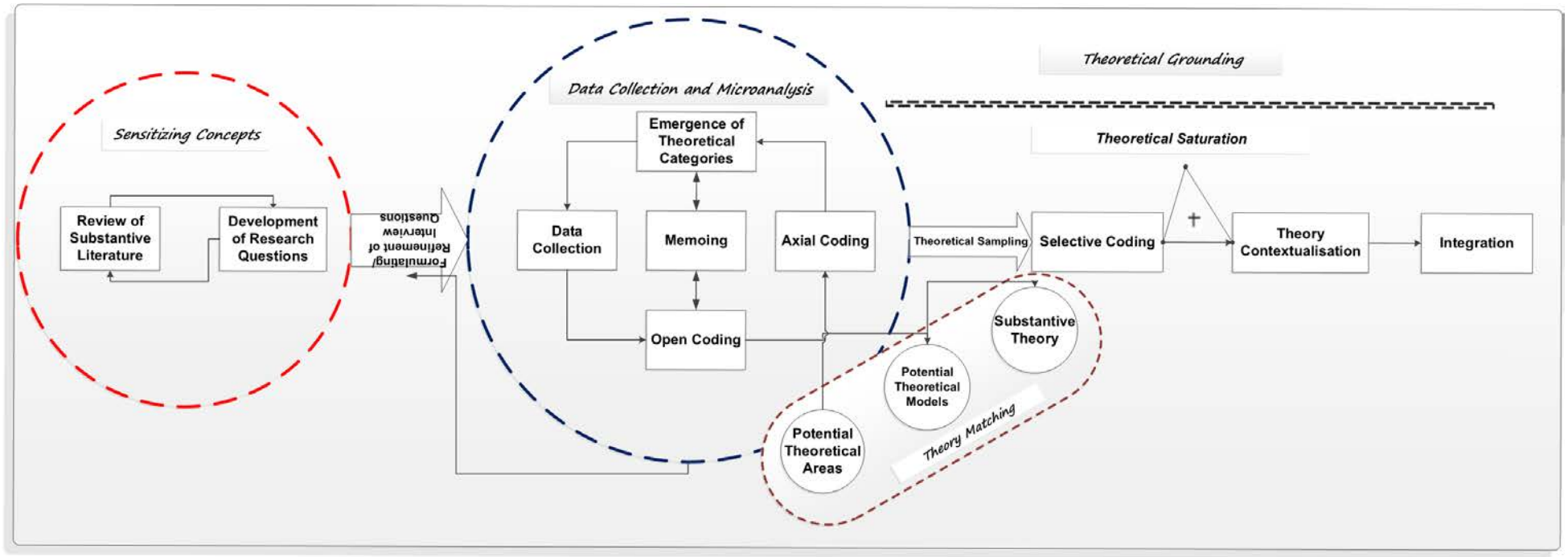

Figure 5.5: Abductive grounded theory process
(Source: Rahmani & Leifels, 2018:5)

The data collection and microanalysis circle (large, blue-dotted circle) shows the iterative process of data collection, open coding, axial coding and the emergence of theoretical categories with memoing during the process. The body of data acquired in this study emerged from various sources. Data collection procedures, such as interviews, documentation and observations, were used (Ibid.), as explained in section 5.9.1.

In Chapter Six (section 6.4), the researcher elaborates on, and demonstrates the data collection and the microanalysis processes.

Data analysis can be done either manually or computationally. Manual data analyses are tedious and time-consuming. Computer-based data analysis programs are manageable, but addressing the learning curve for a novice user can be daunting. The study used ATLAS.ti, a computer-assisted qualitative data analysis software solution (CAQDAS). Most CAQDAS programs are closely associated with Corbin and Strauss' (1990) form of GT, and ATLAS.ti is no exception (Smit, 2002). One of the primary actions performed on ATLAS.ti is coding (Friese, 2019). The definitions of the terms 'code' and 'coding' in qualitative data analysis lean towards GT (Urquhart, 2017; Bryant & Charmaz, 2019; Williams & Moser, 2019). Richardson and Kramer (2006) indicate that GT's continuous process is that of generating hypotheses. If GT is based on abduction, then what emerges from data is synthesised with existing concepts, theories and ideas, which together construct and create themes that are plausible and imaginative. Qualitative data analysis means that themes and patterns are abstracted from verbally, visually and aurally collected body of data.

The next significant step in Rahmani and Leifels's (2018) process is theory matching (the brown dotted oval circle), which begins during data collection and microanalysis. The three main stages of the process of theory abduction are: (i) the identification of the potential theoretical areas; (ii) possible theoretical models; and (iii) substantive theory. The theory matching process begins during data analysis and continues through the theoretical sampling and selective coding. It is here that the merging of coded data categories and sub-categories are identified during the open and axial coding, which leads to the theoretical saturation of categories. The last process ushers in "theoretical grounding", demonstrating the relationships between categories grounded within the abducted theory. The last two steps are contextualising the theory and integration, which are substantially related to the refinement and modification of the theory within the context of the study (Rahmani & Leifels, 2018).

Rambaree's (2018) process complements Rahmani and Leifels's (2018) process, and involves a five-step thematic network analysis (Figure 5.6). The first step is the coding of the data. This step has already been explained. The second step is the identification of themes through a reflection on codes and quotations in ATLAS.ti. Vaismoradi et al. (2016) defined a theme as a high-level abstraction, with a high-level of generality, drawing together ideas. The third step is the creation and description of linkages between the themes to create a constellation of networks. The fourth step develops proposing a plausible model that will be used to answer research questions. The fifth and final step assesses the model for its elegance, coherency and scientific status.

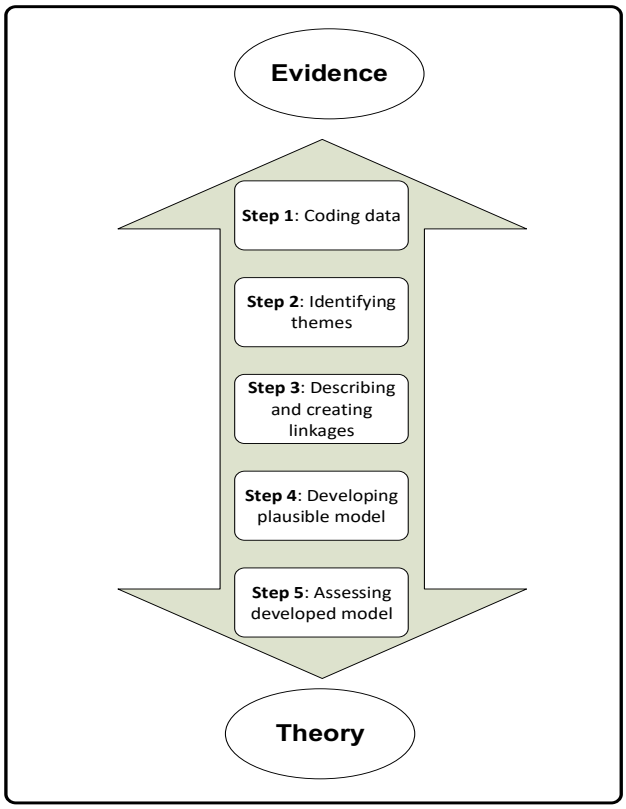

Figure 5.6: Process and steps in abductive thematic network analysis (ATNA) (Source: Rambaree, 2018:67)

Rahmani and Leifels's (2018) process and Rambaree's (2018) process complement one another in the coding stages. The difference between the two processes is that Rambaree's (2018) process is premised on ATLAS.ti.

5.9.2.4 Primary research question analysis

The PRQ sought to design an EA4CD framework guiding the development, deployment and implementation of community-based ICT projects with a view to encourage participation from within the rural and underserved communities. The

themes that emerged in sections 6.2, 6.3, and 6.4 contributed to the analysis of the PRQ.

5.10 Design science research

The narrative in this section reveals the fundamental reasons why DSR was chosen for this study. ~~The historical origin of DSR is as a problem-solving paradigm.~~ The analysis and synthesis techniques distinguish DSR from its peers. The dual nature of DSR, defining design as both an act and an action, promotes DSR as a prescriptive and pragmatic science, as opposed to analytical science (Baskerville et al., 2015; Thuan et al., 2019).

Herbert A. Simon's seminal article entitled "The Sciences of the Artificial" proposes scientific methods for manmade artefacts (Simon, 1996). Simon (1996) presents a process of creating human-made artefacts, particularly understanding the role of analysis (observation) and the role of synthesising (making) in the process. Thus, he demonstrates that DSR is the science of how to create artificial things with functions and adaptations. DSR has roots in the engineering, medicine, business, architecture, and painting science fields (Ibid.). As a result, DSR is fundamental to all professional training, laying its footprint in the design disciplines and distinguishing itself as a science.

The word 'design' is both a verb and a noun, which lends itself to an in-depth understanding of DSR (Gregor & Iivari, 2007; Hevner & Chatterjee, 2010; Baskerville et al., 2016; Carstensen & Bernhard, 2019). Design, as a verb, brings to the fore the central activity of IS practitioners which is the "act of planning or creating something for a specific purpose or process that is goal-oriented, where the goal is solving problems, meeting needs, improving situations, or creating something new or useful" (Baskerville et al., 2015:A1). Design, as a noun, is a process that devises "courses of action aimed at changing existing situations into preferred ones" (Ibid.) The course of action in DSR has taken the research further from description and explanatory investigations to empirical investigation. Prior research in rural and underserved communities has been mainly descriptive and explanatory research, with limited successes. The situation has to change in order to accommodate action research design that will realise the necessary changes within the communities.

Simon's DSR contributes to the two notions of *bounded rationality* and *satisficing* (Simon, 1996). According to Simon (1996), *bounded rationality* is a state where people are limited in absorbing information, how they process information, and the time available to make a decision, whereas s*atisficing*, a combination of the two words *satisfy* and *suffice*, means 'a good enough' decision or a satisfactory solution,

rather than an optimal decision or solution. Each rural and underserved community demonstrates bounded rationality, thus establishing grounds to implement adequate solutions. The two concepts of *bounded rationality* and *satisficing* form the basis of a DSR study. Furthermore, Baskerville et al. (2015:1) explain that "[d]esign cannot proceed without: (i) the articulation of the goals of the designed artefact, (ii) knowledge of the environment; (iii) mechanisms to produce design alternatives and (iv) understanding of the effects of design decisions, with respect to articulated goals".

DSR contributes to the construction of human-made artefacts that have functions, goals and adaptability (Simon, 1996). These artefacts are expected to change and improve the environment. Hevner (2007) demonstrates that DSR has three cyclic views, namely relevance cycle, design cycle and rigour cycle, that must be addressed adequately (Figure 5.7). These three views are extracted from Hevner et al. (2004). The critical cycle is the design cycle, which operates between the relevance cycle and rigour cycle. The relevance cycle comprises an environment that consists of people, organisations, technical systems, and problems, providing opportunities for design science activities. The rigour cycle, on the other hand, consists of the knowledge base of science, which comprises scientific theories and methods; experience and expertise; and meta-artefacts. The process of design applies knowledge to make new artefacts, making improvements to a system. Van Aken (2005:22) demonstrates that DSR "is often pragmatic and solution-oriented". Dresch et al. (2014:56) argue that pragmatic validity does not only apply to knowledge but creates knowledge. Pragmatic validity is a utility that ensures that the proposed solution will work in the given environment.

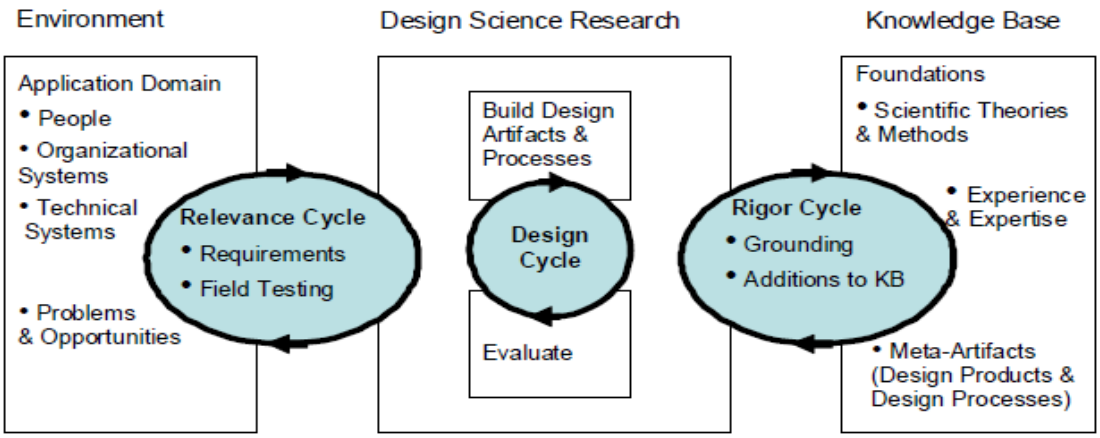

Figure 5.7: Design science research cycles
(Source: Hevner, 2007:88)

Dresch et al. (2014) argue that DSR does not focus on seeking optimal solutions, such as in Operational Research, but aims to find a satisfactory outcome, as stated earlier. Traditional, natural or social sciences contribute descriptive knowledge, which provides an in-depth understanding and explanation of the studied phenomenon (Ibid.). However, DSR provides prescriptive knowledge, which offers the ability to translate expert knowledge into actionable knowledge for non-expert users. A pragmatic approach in rural and underserved communities contributes to the essence of the attributes that define the rurality of the community.

The two concepts, *bounded rationality* and *satisficing,* have led to the coining of the definitions of design science, artefacts, satisfactory solutions, classes of problems and pragmatic validity, as shown in Figure 5.8 (Dresch et al., 2014). The design science definition helps inform what it seeks to do. The design of an artefact is a product the DSR. A satisfactory solution is required to solve the current problems. The artefact should generalise and address a class or a range of issues. Pragmatic validity ensures that truth and utility are the hallmarks of the quality of DSR.

New knowledge created through designing artefacts, the analysis of the use and/or performance of new or improved artefacts, and the abstraction of such artefacts contributes to the improvement of an understanding of the behavioural aspects of IS, which are all necessary ingredients to affirm the strong bond that exists between truth and utility in DSR (Vaishnavi & Kuechler, 2004).

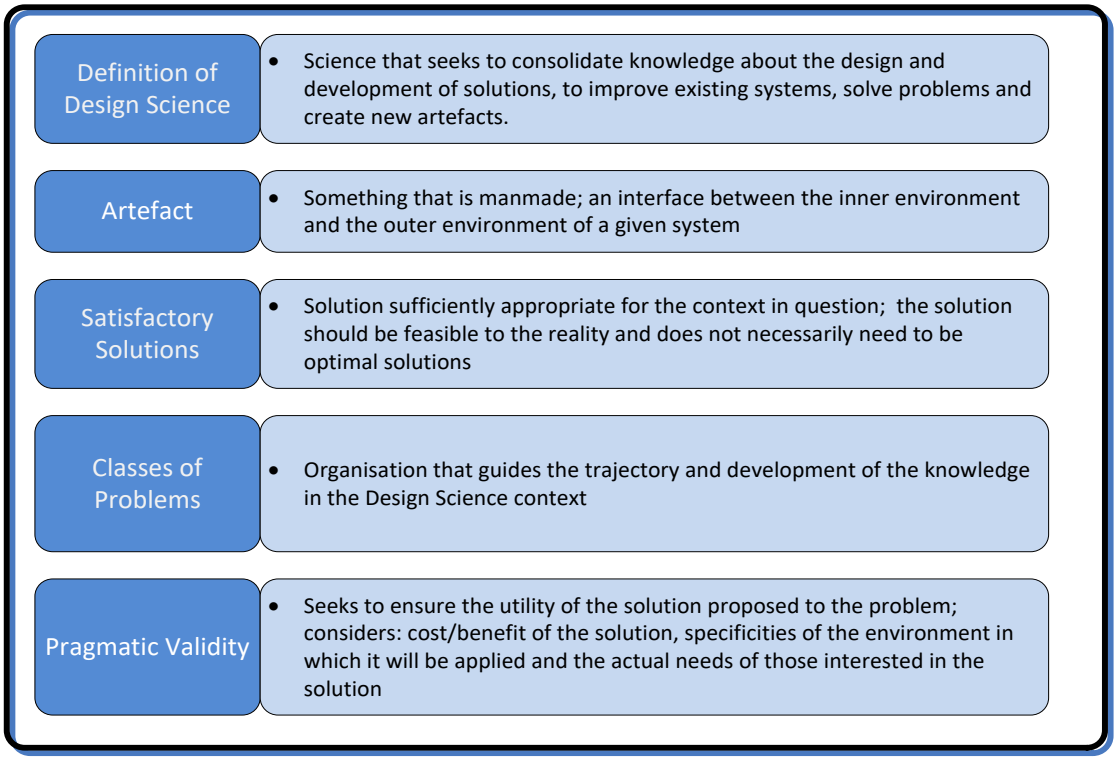

Figure 5.8: Main concepts of design science research

(Adopted from Dresch et al., 2014:59)

A detailed research design that for provides a unified and comprehensive research design, which integrates all the different aspects discussed thus far, is presented in the next section.

5.11 Detailed research process

In this study, the researcher proposes an artefact in the form of a framework that can develop prescriptive knowledge using nuances of the descriptions that DSR pioneers articulated. The relationship between academics, practitioners and the community; and between CI and EA disciplines, is necessary for community-based ICT projects. The next step dealt with the DSR research strategy applied to accomplish the stated goal.

The detailed DSR process that the study selected emanates from prior research done by Nunamaker et al. (1991), Walls et al. (1992), March and Smith (1995), and Vaishnavi and Kuechler (2015). These pioneers brought attention to DSR research designs that respond to a class of problems. Nunamaker et al.'s (1991:94-95) seminal paper proposes a framework or model for contextualising the role of system development in IS Research. This model includes the following areas of research activity: (i) theory building; (ii) system development; (iii) experimentation; and (iv) field studies (Venable, 2006). Venable (2006) modified the Nunamaker framework (1991) to include: (i) theory building; (ii) solution technology invention (rather than the more specialised 'system development'); (iii) artificial evaluation; and (iv) naturalistic evaluation. Venable's (2006:185) framework defines a solution technology invention as "any approach to improving an organisation, including information systems, information technology, systems development methods, algorithms, managerial practices, and many other technologies or techniques", which is the core of DSR.

Shortly after Nunamaker's (1991) framework was presented, Walls et al. (1992) presented the components of information system design theories (ISDT) necessary to build and test design theories. Walls et al. (1992) divides ISDT into two categories, involving design as a product (noun) and design as a process (verb). This study adopted Vaishnavi and Kuechler's (2015) DSR process because of the pragmatic approach taken by DSR to developing an artefact that provides a critical solution to a practical problem. The DSR process builds in utility, quality, efficacy and rigour into the design process. The study approach is qualitative, because

during the design phase, human interpretations featured most in the design of the final framework.

Table 5.5 illustrates similar research approaches that have been adopted since the 1990s. In all these processes, the authors sought to fulfil the design science requirements of rigour and relevance (Hevner et al., 2004). According to Goldkuhl and Lind (2010:45), the separation between design research (meta-design) producing abstract design knowledge and empirical design practice providing situational knowledge and artefacts, is a critical feature in defining the multi-grounding approach.

Table 5.4: Comparison of design science research processes since 1990 (Adopted from Offermann et al., 2009:4)

	Takeda et al. (1990)	Nunamaker et al. (1991)	March and Smith (1995)	Peffers et al. (2008)	Offermann et al. (2009)	Vaishnavi and Kuechler (2015)
Problem Identification	Enumeration of problems	Construct a Conceptual Framework		Problem identification and motivation Define the objectives for a solution	Identify problem Literature research Expert interviews Pre-evaluate relevance	Awareness of Problem
Solution Design	Suggestion Development	Develop system architecture Analyse & design system Build system	Build	Design and development	Design artefact Literature research	Suggestion Development
Evaluation	Evaluation of confirming the solution The decision on a solution	Observe & evaluate the system	Evaluate	Demonstration Evaluation	Refine hypothesis Expert survey Laboratory experiment Case study / action research Summarise results	Evaluation Conclusion

Vaishnavi and Kuechler's (2015:15) DSR process has five phases: (i) awareness of the problem; (ii) suggestion; (iii) development; (iv) evaluation; and (v) conclusion (Figure 5.9).

i) ***Awareness of the problem***: This phase represents the proposal stages of the problem. The proposal is the result of a need that arises from the practical experiences of the participants.

ii) ***Suggestion:*** The proposal phase results in a tentative design; a creative step defining the functionalities proposed to solve the current problem.

iii) ***Development:*** The development phase implements the tentative design into an artefact. Various theories are used to inform the design of the artefact.

iv) ***Evaluation:*** The designed artefact's requirements are evaluated to test its ability to solve the desired problem. The results of the evaluation can lead to more design cycles of the DSR model.

v) ***Conclusion:*** The conclusion phase identifies research results and knowledge contributions. This step consolidates and communicates the

results of the DSR cycle. The generated theory can further result in the implementation of more DSR cycles.

Each of the phases is reducible into manageable steps to produce an outcome. While each phase is defined and iteration that occurs in each phase is indicated by arrows branching backwards, indicating the strength the cyclic action of each phase. For example, in the development and evaluation phases of an artefact, it may be necessary to go back to the awareness problem in order to further refine and refocus the definition of the proposal. Circumscription generates additional and critical knowledge gained during the construction of the artefact, valid and restricted within the confines of the problem context (Adebesin et al., 2011:314).

The study adopted Vaishnavi and Kuechler's (2015:15) DSR process (Figure 5.11). The DSR approach responded to the main research problem and the three DSR sub-cycles (Kotzé et al., 2015). The three DSR sub-cycles matched the three sub-research questions (SRQ) and the DSR main cycle matched the primary research question (section 1.4.3). Each DSR sub-cycle applies the first three DSR phases of awareness of the problem, suggestion and the development phase. The result obtained from the three DSR sub-cycles feed into the DSR's main cycle. Figure 5.10 adapts Figure 5.9, considering the three DSR sub-cycles pertaining to the SRQ 1, SRQ 2 and SRQ 3 respectively.

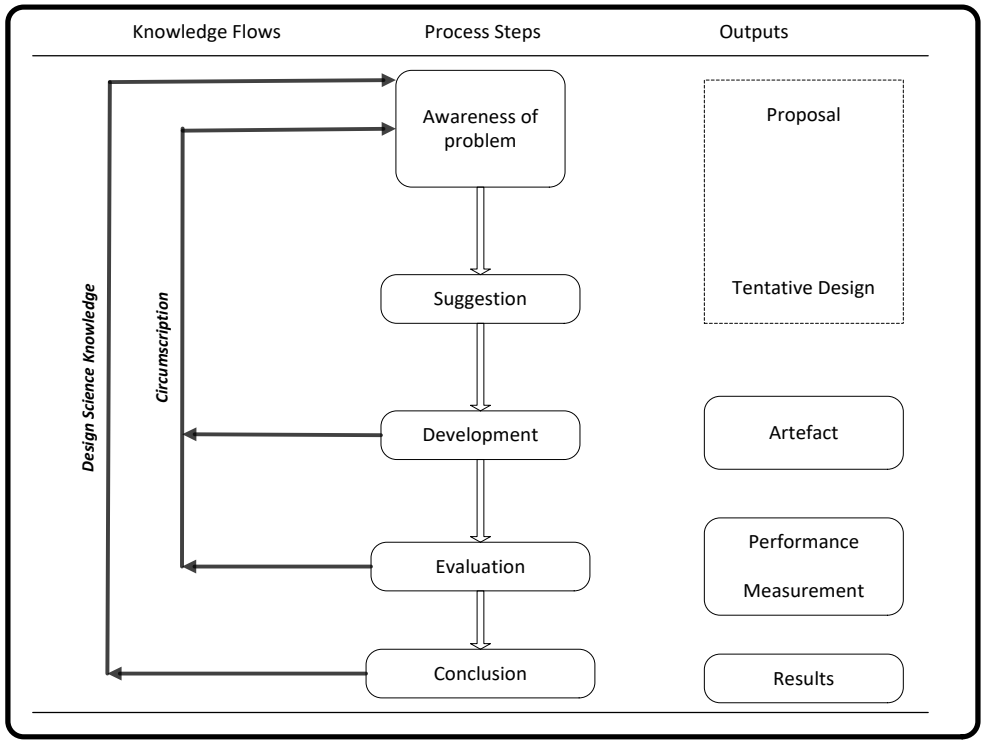

Figure 5.9: Design science research cycle
(Source: Vaishnavi & Kuechler, 2015:15)

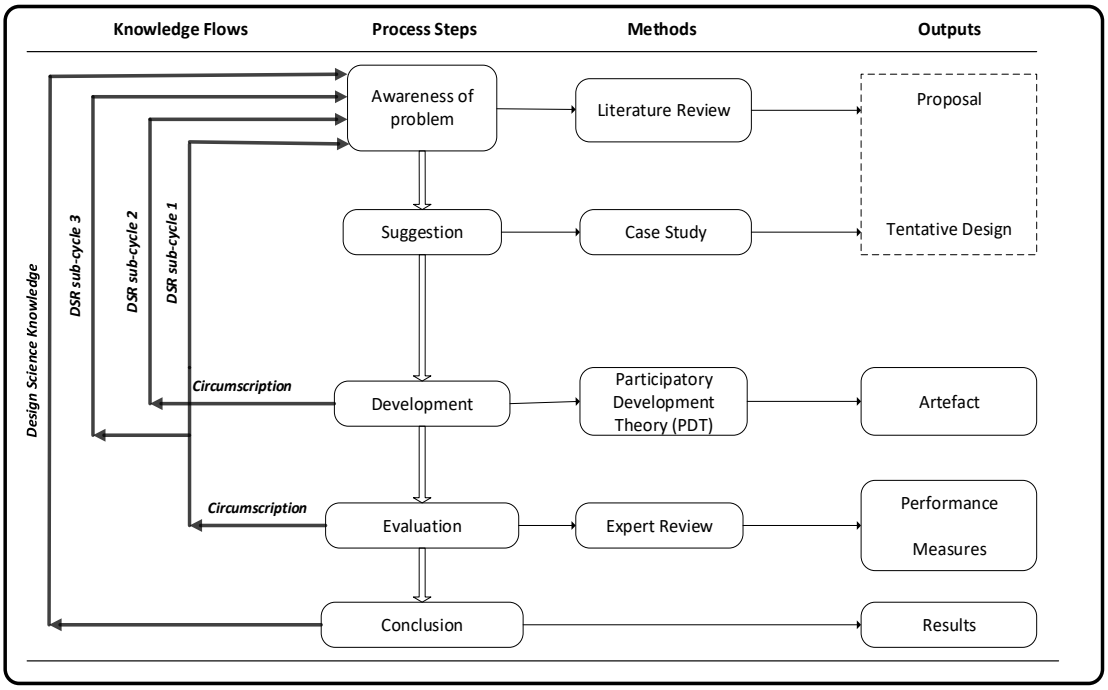

Figure 5.10: Design science research cycle
(Adapted from Vaishnavi & Kuechler, 2015:15)

Figure 5.11 demonstrates further how the DSR main cycle and three DSR sub-cycle processes interact with each other when responding to the research questions posed in this study (section 1.4.3). Figure 5.12 shows the relationship between the DSR main cycle and the three DSR sub-cycles, as well as the PRQ and three SRQs defined section 1.4.3. The approach maps with the conceptual framework illustrated in Figure 3.5. The DSR main cycle is the primary research, which explains the phases followed in designing the artefact (EA4CD framework). The artefact is necessary to assist in developing, deploying and implementing the community-based ICT projects in rural and underserved communities. The three sub-cycles (DSR sub-cycle 1, 2, 3) of the research process follow three of the five phases that feed into the development stage of the main phase. During DSR sub-cycle 1, analyses of the common understanding of community needs and CI principles needs are undertaken, while the DSR sub-cycle 2 involves an analysis the common understanding of the community's needs and the government's EA concepts.

Finally, during DSR sub-cycle 3, an analysis of the common knowledge between government EA and CI principles occurs. All of the three sub-cycles are DSR approaches in full standing, considering the awareness, suggestion and development phases that feed into the DSR main cycle. In Chapter Six, the researcher further demonstrates the actual development of the design artefact. In the fourth sub-phase of the main phase, an evaluation of the designed artefact is undertaken and the findings discussed. In section 5.12, the researcher outlines the

DSR evaluation process applied in Chapter Seven. Finally, in Chapter Eight, the researcher deals with the contributions made by DSR.

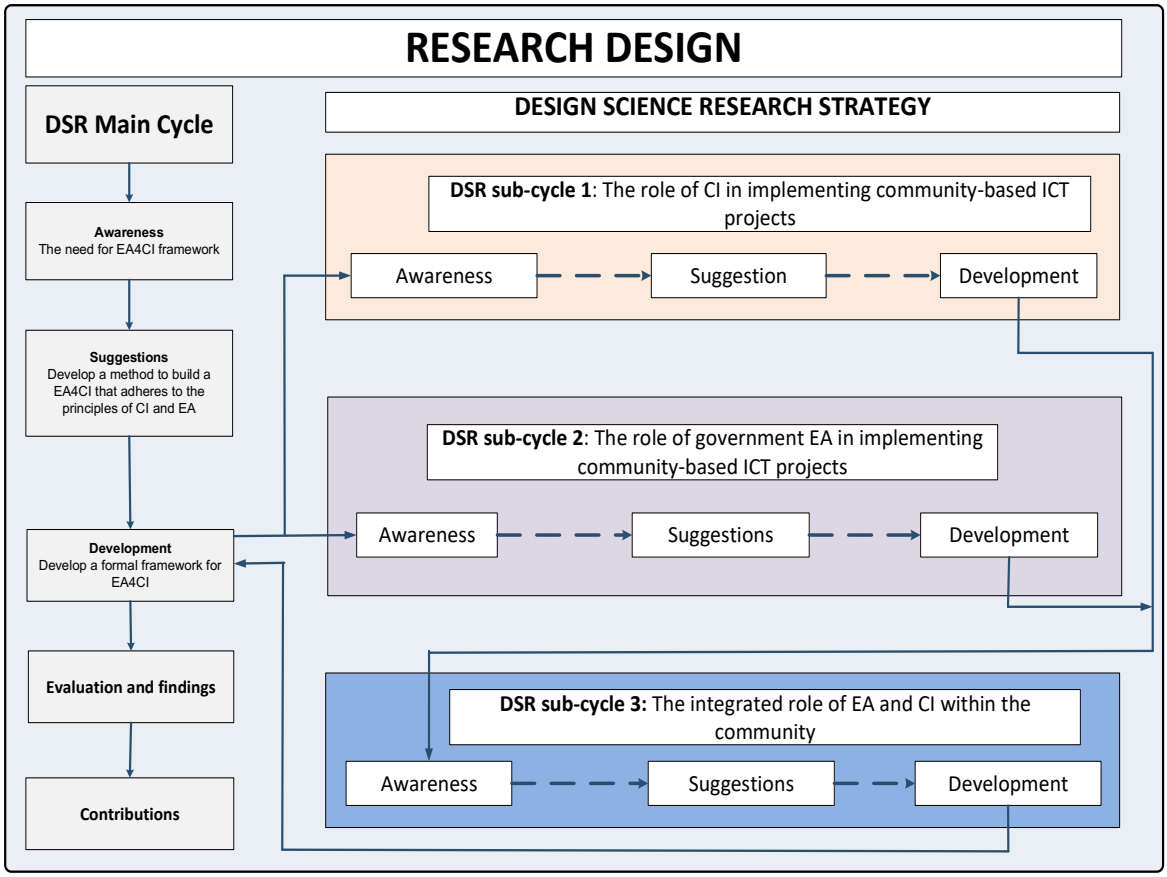

Figure 5.11: Design science research process for this study

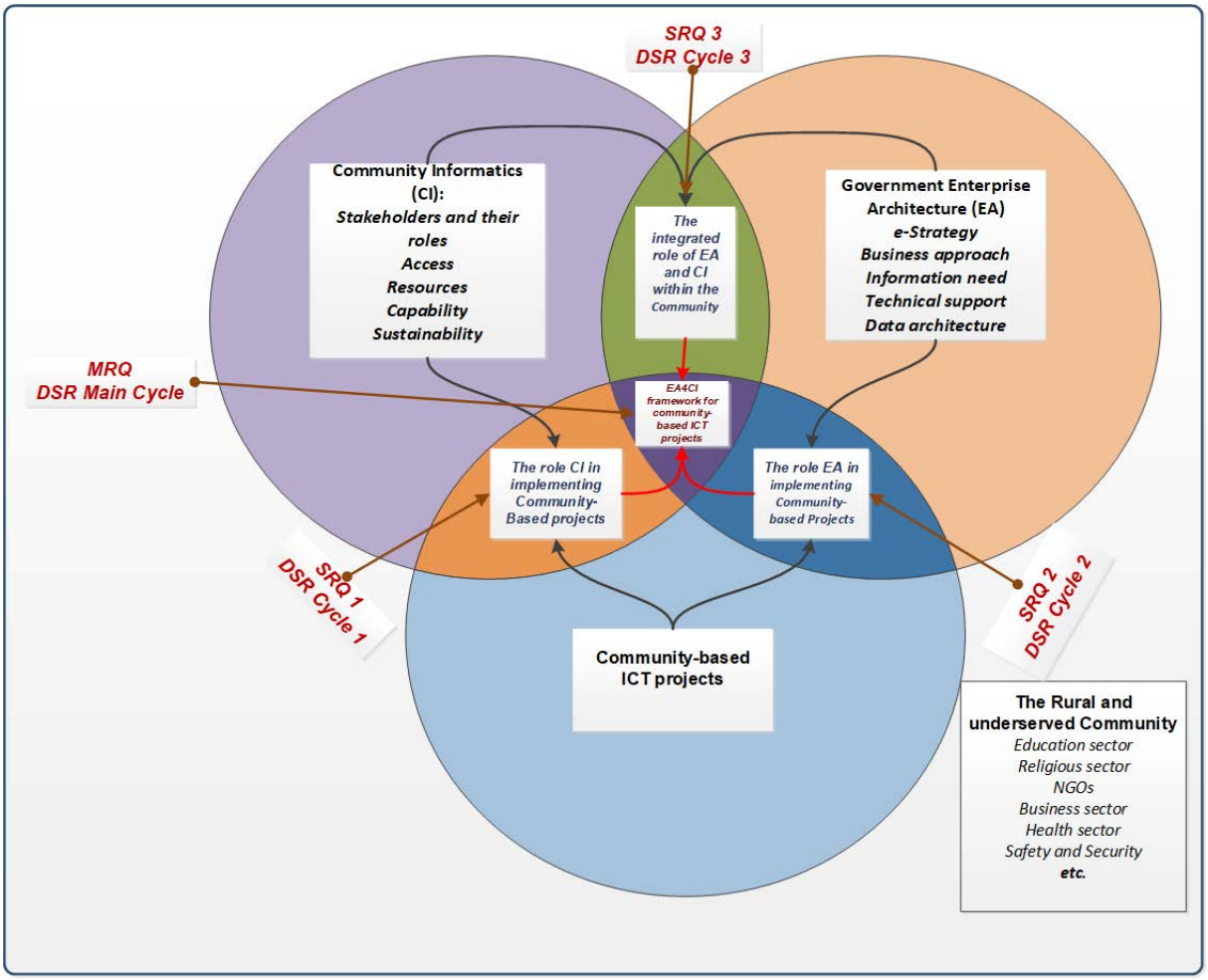

Figure 5.12: Conceptual framework showing research questions
(Legends: PRQ = Primary Research Question; SRQ = Sub-Research Question)

5.12 DSR evaluation process

Evaluation in DSR is as critical as building the artefact. Sonnenberg and vom Brocke (2012) argue that DSR concentrates on developing the artefacts but neglects DSR evaluation. DSR evaluation guarantees validity, fitness for purpose and utility.

This research prioritises contextual factors that are deemed to retard progress in rural and underserved communities. The research design is required to determine which aspects are essential, more important, less critical, beautiful to have or irrelevant. This understanding assists in describing the evaluation design process. Sonnenberg and vom Brocke (2012) suggest that DSR evaluation can be interspersed within the design process, as shown in Figure 5.13. This suggestion gives credence to Hevner's (2007) design cycle, which proposes an oscillation between 'build' and 'evaluate'. *Ex-ante* and *ex-post* evaluations are necessary evaluations undertaken during the design cycle (Sonnenberg & Vom Brocke, 2012).

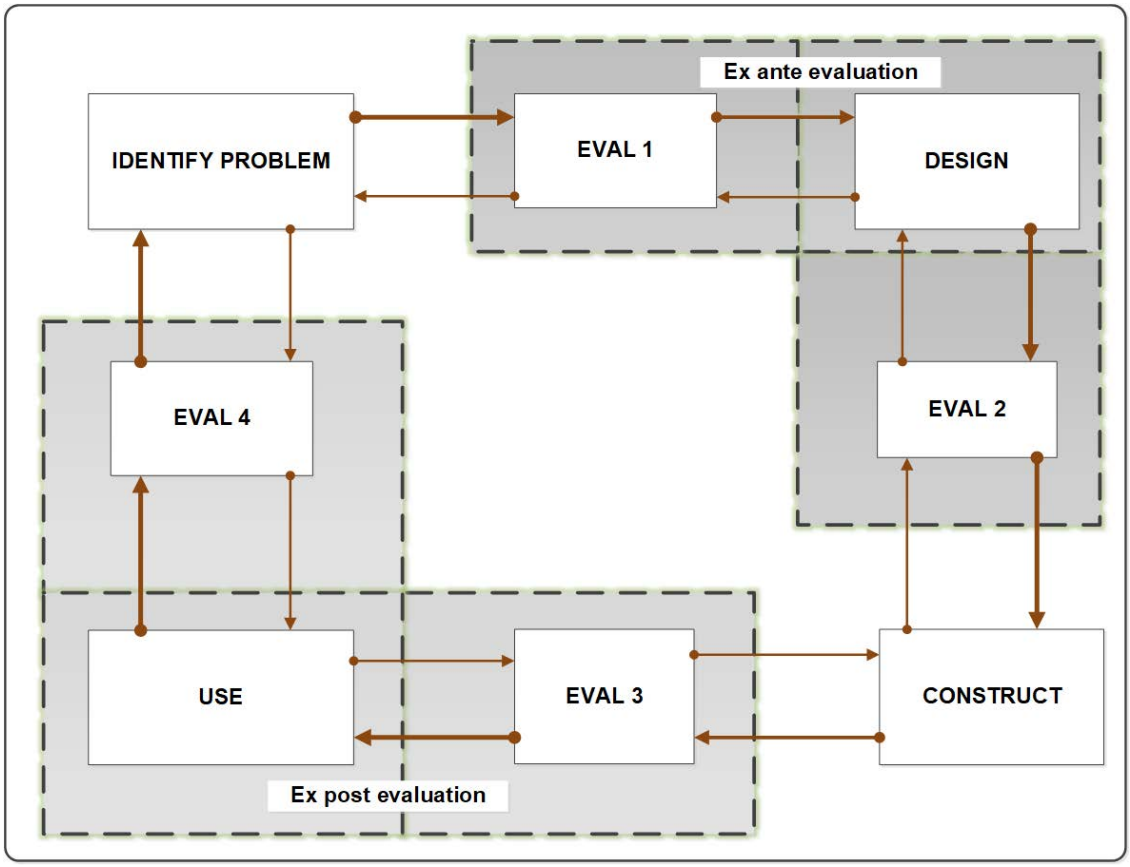

Figure 5.13: Evaluation activities within a DSR process
(Source: Sonnenberg & Vom Brocke, 2012:6)

The researcher adopted Shrestha et al.'s (2014) logic model, comprising three phases, as a way of communicating the DSR evaluation (Figure 5.14). The first phase is the input phase, which describes the purpose of the artefact. This phase also develops the evaluation protocol derived from available evaluation strategies.

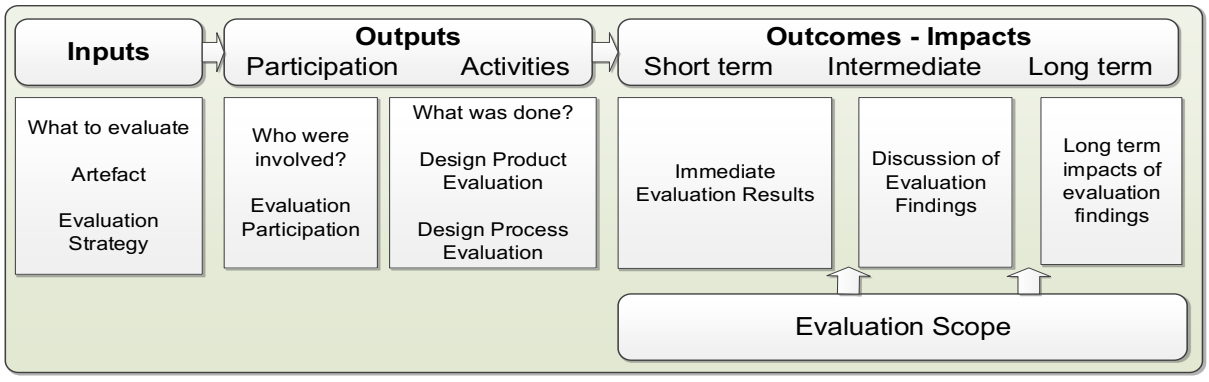

Figure 5.14: DSR evaluation reporting structure
(Source: Shrestha et al., 2014:3)

The evaluation strategy in Shrestha's (2014) first phase, depicted as input in Figure 5.14, deals with Venable et al.'s (2012:434-435) evaluation protocol, comprising four evaluation components: Firstly, an in-depth analysis of evaluation requirements;

secondly, matching the evaluation requirements to *ex-ante* or *ex-post* evaluations and to naturalistic or artificial evaluation criteria in Table 5.6. Naturalistic evaluations are empirical, tending towards interpretivism. Artificial evaluations are either empirical or non-empirical investigations and are always positivist and reductionist in approach. Thirdly, selecting an appropriate evaluation method(s) from the list in Table 5.7 (it is possible to choose one or more methods); and finally, the detailed DSR evaluation process is determined.

Table 5.5: DSR evaluation strategy selection framework (Source: Venable et al., 2012:432)

DSR Evaluation Strategy Selection Framework		***Ex-Ante***	***Ex-Post***
		Formative Lower building cost Faster Evaluate design, partial or full prototype Less risk to participants (during evaluation) Higher risk of false positive	Summative Higher building cost Slower Evaluate instantiation Higher risk to participants (during evaluation) Lower risk of false positive
Naturalistic	Many diverse stakeholders Substantial conflict Socio-technical artefacts Higher cost Longer time – slower Organisational access needed Artefact effectiveness evaluation Desired rigour: "Proof of Pudding" Higher risk to participants Lower risk of false-positive – critical safety systems	Real users, real problem, and somewhat unreal system Lower-medium cost Medium speed Low risk to participants Higher risk of false positive	Real users, real problem, and real system Highest cost Highest risk to participants Best evaluation of effectiveness Identification of side effects Lower risk of false positive – safety-critical systems
Artificial	Few similar stakeholders Little or no conflict Purely technical artefacts Lower cost Less time – faster Desired rigor: Control of variables Artefact efficacy evaluation Less risk during evaluation Higher risk of false positive	Unreal users, problem, and/or system Lowest cost Fastest Lowest risk of false positive, effectiveness	Real users, unreal problem, and possibly unreal users Medium-high cost Medium speed Low-medium risk to participants

Table 5.6: DSR evaluation method selection framework (Source: Venable et al., 2012:434)

DSR Evaluation Method Selection Framework	*Ex-Ante*	*Ex-Post*
Naturalistic	Action research Focus group	Action research Case study Focus group Participant observation Ethnography Phenomenology Survey (qualitative or quantitate)
Artificial	Mathematical or logical proof Criteria-based evaluation Lab experiment Computer simulation	Mathematical or logical proof Lab experiment Role-playing simulation Computer simulation Field experiment

Shrestha et al.'s (2014) second phase is called output. This phase deals with evaluation activities comprising the design process (DSR methodology) and design product (artefact). The phase focuses observing the evaluation protocol (Ibid.).

Venable et al. (2016) provide a detailed DSR evaluation process framework, known as the Framework for Evaluation in Design Science (FEDS). Table 5.8 describes the circumstances that will assist in selecting an appropriate DSR evaluation strategy. In each strategy, FEDS has a dual strategy that relies on two dimensions of analysis: (i) the functional purpose of the evaluation (formative or summative); and (ii) the paradigm of the evaluation (artificial or naturalistic) (Venable et al., 2016).

This study's strategy involved the 'human risk and effectiveness' evaluation, with the emphasis on the *ex-ante* evaluations at an early stage of the DSR cycle process; and, later in the process, *ex-post* evaluations took effect. *Ex-post* evaluations are beyond the scope of this study. Prat et al. (2014) relate the evaluation method to criteria and sub-criteria for IS artefacts, as shown in Figure 5.15. The designed artefact in this study was designed within a system. Since the IT/IS artefacts are considered a system (Gregor, 2010), Prat et al.'s (2014) system hierarchy of criteria is comprised of five dimensions of systems that formulated the basis for an in-depth evaluation, as shown in Figure 5.15.

Shrestha et al.'s (2014) third phase has three dimensions with respect to evaluation outcomes: (i) short-term; (ii) intermediate term; and (iii) long-term outcomes of a DSR evaluation, as shown in Figure 5.14.

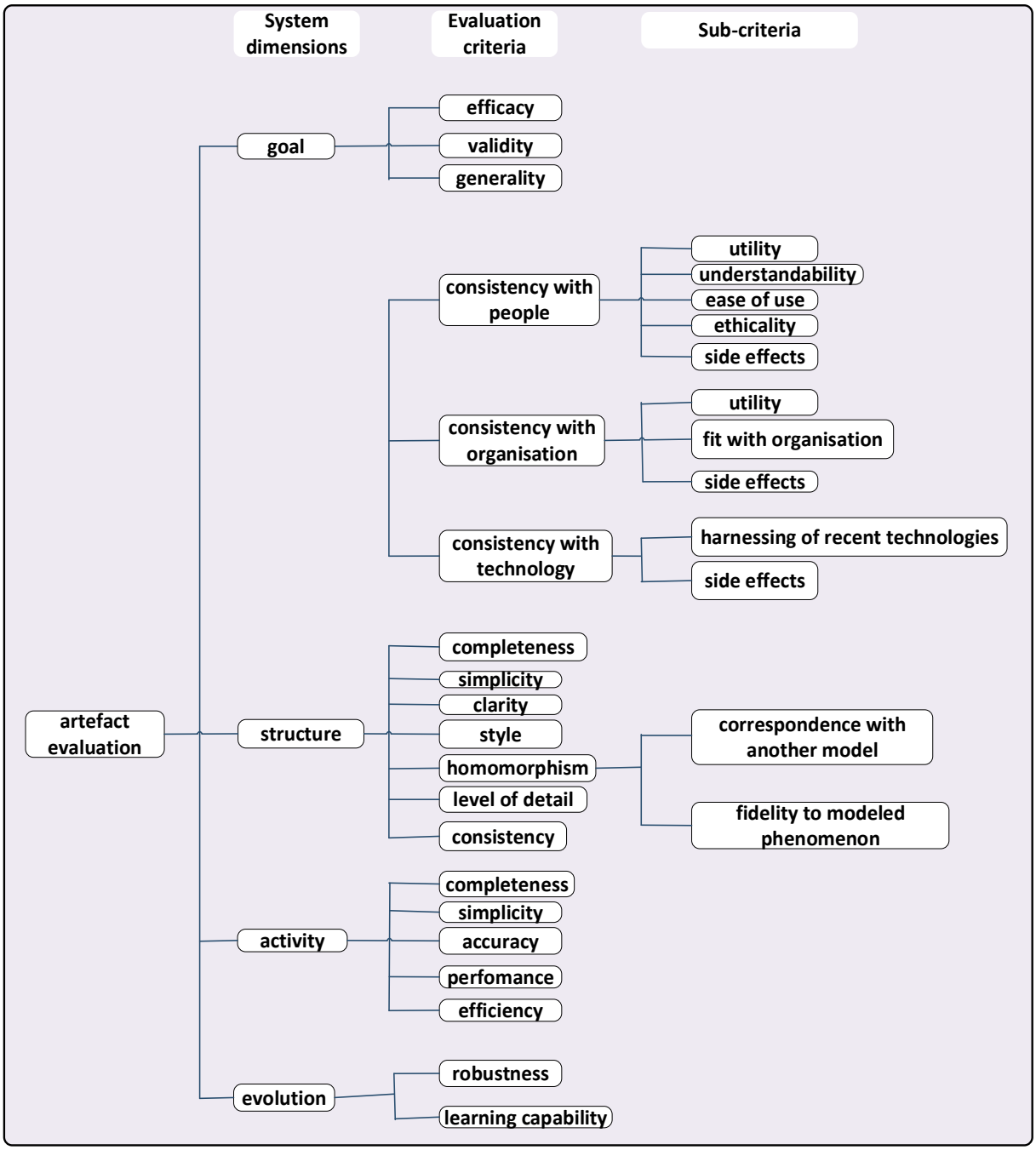

Figure 5.15: The hierarchy of criteria for IS artefact evaluation (Source: Prat et al., 2014:6)

Table 5.7: Circumstances for selecting a relevant DSR evaluation strategy (Source: Venable et al., 2016:6)

DSR evaluation strategy	Circumstance selection criteria
Quick and simple	If small and simple construction of design, with low social and technical risk and uncertainty
Human risk and effectiveness	If the major design risk is social or user-oriented *and/or* If it is relatively cheap to evaluate with real users in their real context *and/or* If a critical goal of the evaluation is to rigorously establish that the utility/benefit will continue in real situations and in the long run

DSR evaluation strategy	Circumstance selection criteria
Technical risk and efficacy	If the major design risk is technically oriented *and/or* If it is prohibitively expensive to evaluate with real users and real systems in a real setting *and/or* If a critical goal of the evaluation is to rigorously establish that the utility/benefit is due to the artefact, not something else
Purely technical artefact	If artefact is purely technical (no social aspects) or artefact use will be well in future and not today

Vaishnavi and Kuechler (2004) advise the researcher not to be hesitant mentioning the limitations of the evaluation strategy. The evaluation research conducted in this study was both short-term and *ex-ante* evaluation. The evaluation is limited, requiring more time to continue with the longitudinal study. As the design continues, more in-depth evaluations are undertaken. These evaluations are part of the "build-evaluate" cycles described by Hevner et al. (2004).

5.13 Ethical contributions

The result of DSR is the creation of effective, efficient and innovative artefacts and of knowledge, having the potential to change how communities live and, invariably making the world a better or worse place to live in (Iivari, 2007; Myers & Venable, 2014). Myers and Venable (2014) have identified six ethical considerations. These are:

i) **The public interest:** The artefact's construction affected the community and the government. Public interest during the building of the artefact was critical.

ii) **Informed consent:** All participants during this study were informed of their rights and the risks involved. They were informed of the right to withdraw their participation at any time, without prejudice to themselves. Participants were not rewarded for their participation.

iii) **Privacy:** Participants' rights to privacy and security were respected. The selected interview venues were private. All participants' data were kept secure and private. No private photographs of participants were used in the thesis. Pseudo names were assigned to participants for reporting purposes only.

iv) **Honesty and accuracy**: Claims about created artefacts and their utility were not exaggerated or understated. Any side effects that could have arisen as a result of the interview process were quickly corrected. False promises were avoided at all cost.

v) **Property:** Ownership of information and data storage were explained to the participant. Participants were informed of how and when this data would be destroyed.

vi) **Quality of the artefact**: Input data or interviews conducted with the participants were verified with the participants. In addition, the designed process and product are evaluated in Chapter Seven as a way of checking quality.

Ethical clearance from the university's ethics committee was obtained (Appendix F). All prospective interviewees signed consent letters indicating that their participation is voluntary.

It is doubtful whether any of the dominating social sciences in IS field are value-free (Myers & Venable, 2014). However, it is even more important for DSR researchers to state explicitly their ethical values clearly (Iivari, 2007).

5.14 Summary

In this chapter, the researcher crafted the research design used in the study, using the metaphor of the research onion provided by Saunders et al. (2019). The starting point of the chapter was the description of philosophical assumptions, followed by research paradigms, then approaches to theory development and the purpose of the research. The researcher further presented a systematic methodological choice necessary to implement an empirical study. At the centre of this research is the DSR, as a research strategy. The phased approach of DSR was the preferred strategy adopted in this research. The researcher also dealt with how data collection strategies and data analysis processes were selected. In section 5.2, the researcher presented the philosophical stance adopted for this study, declaring ontological idealism as best suited to contextual study. The epistemological stance of 'knowing through design' compliments the ontological stance and was adopted in this study.

The value-free and value-bound judgments define the axiological stance. The rhetorical stance adopted in this study lends itself to appropriate language usage. Concepts and theories prove their worth through pragmatism; hence, the pragmatic research paradigm guided the researcher to adopt abduction and induction.

The researcher opted for the formative *ex-ante* evaluation strategy used to design the artefact, EA4CD. Finally, ethical considerations were dealt with.

In the next chapter, the author will present the empirical research findings.

CHAPTER SIX: DEVELOPMENT OF ENTERPRISE ARCHITECTURE FOR COMMUNITY DEVELOPMENT FRAMEWORK (EA4CD): DESIGN ARTEFACT

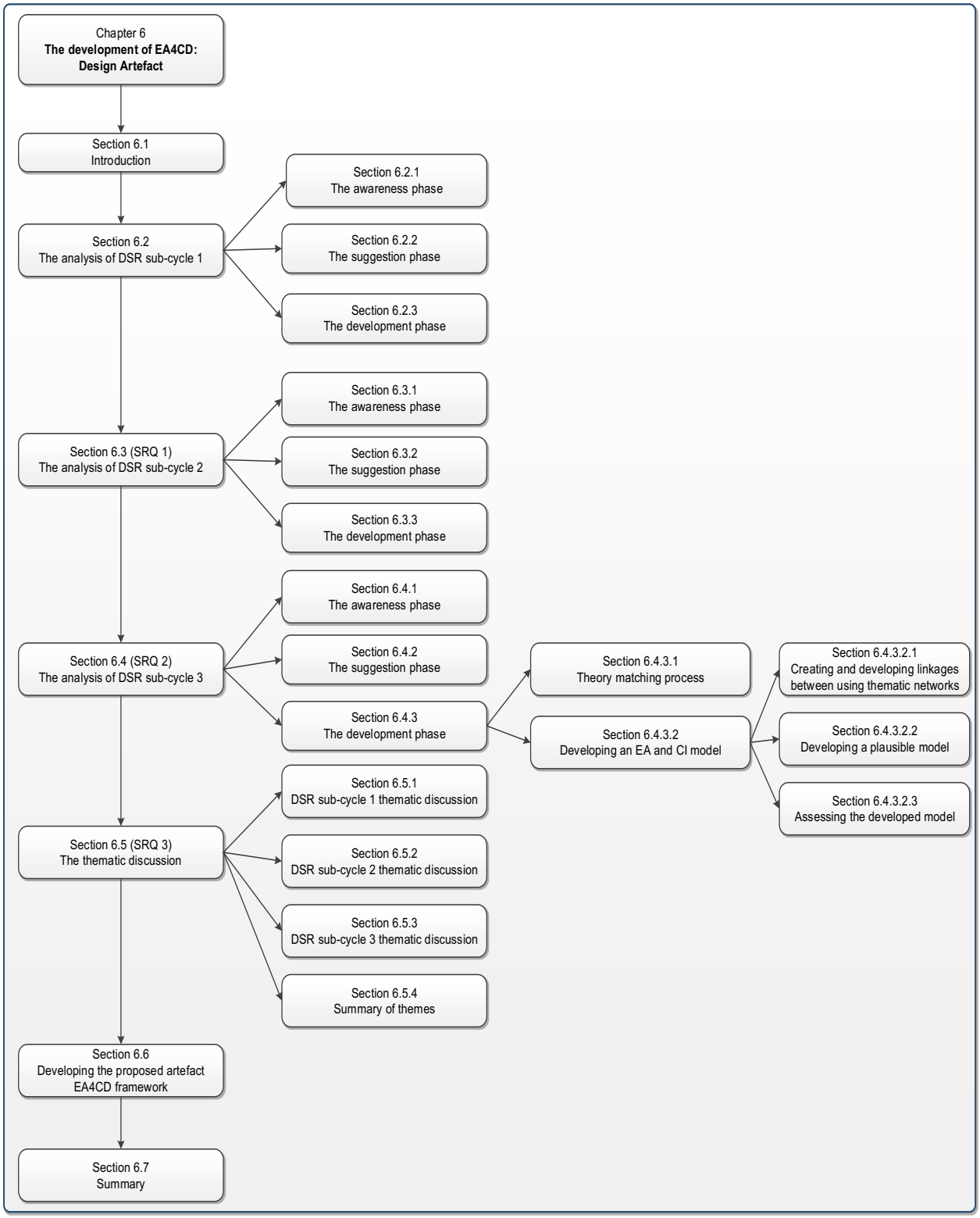

Figure 6.1: Chapter Six flow

6.1 Introduction

In Chapter Five, the researcher described the research design process, explaining how empirical research may respond to the research questions mentioned in Chapter One. In Chapter Six, the researcher describes the DSR development used in this research (Figure 6.1).

DSR was at the centre of the design, delineating the evolution of the design artefact in order to present a solution to the contextual problem.

The primary research question (PRQ) posed is:

PRQ: How can an Enterprise Architecture for Community Development (EA4CD) framework be developed to integrate EA, CI and community needs to assist with the implementation of community-based ICT projects in rural and underserved communities?

In the SLR discussed in Chapter Two, the evolution of EA was presented, showing how EA has evolved since 1987 (section 2.4) to a stage that governments can now claim reasonable successes because of its business approaches, information needs, and technical and data architectures (section 2.6). However, in the same chapter, is the researcher showed that the role EA can play in communities is lacking and requires an empirical study. Furthermore, the role of EA requires further investigation into the articulation of how community development in rural and underserved communities can be improved. It is for this reason that the pragmatic PRQ is asked.

In Chapter Three, the researcher dealt with the analytical theoretical framework, PDT, which was presented as the lens through which the empirical study examined how community-based ICT projects can be used for community development (Figure 3.4). In the same chapter, the researcher presented a conceptual framework consisting of EA in government, CI in the community, and the community needs as a system of concepts, constructs and variables necessary to define how EA (Figure 3.5) could be used for community development.

The EA4CD framework was developed to address the developmental challenges that rural and underserved communities face amid progress in the field of IT and IS. The conceptual framework presented in section 3.7, involved a blueprint that responds to the challenge (Figure 6.2). The success of such a framework would contribute to an improvement of the meaningful use of community-based ICT projects designed to improve the livelihood of the rural and underserved communities. The five-phase DSR process presented by the researcher in section

5.11, Figure 5.10, as proposed by Vaishnavi and Kuechler (2015:15) and adapted for this study, intended to respond to the main RQ and the three secondary sub-research questions (SRQ) (section 1.5).

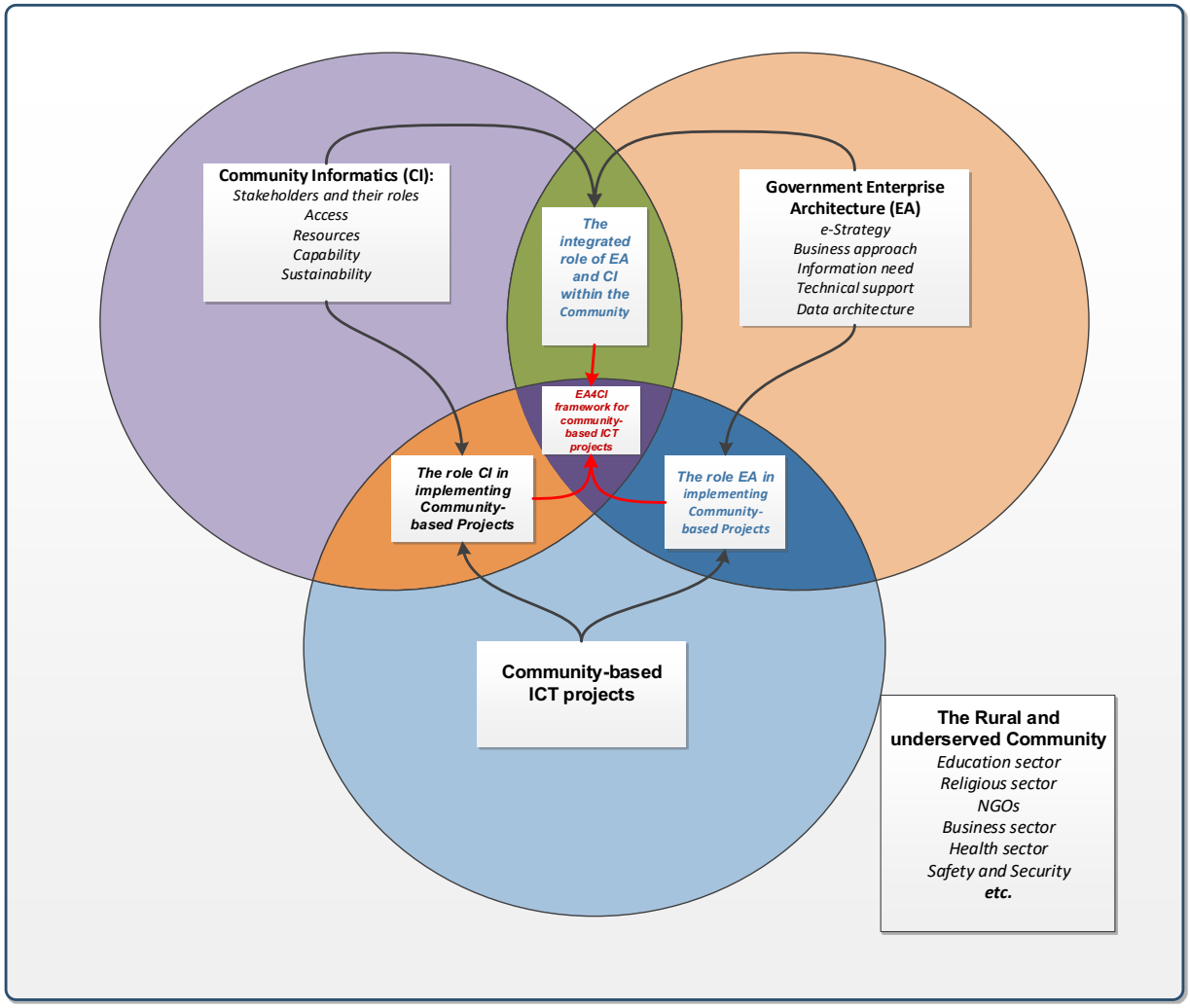

Figure 6.2: Conceptual framework

The Gerald Wright Thusong Service Centre stakeholder meeting held in Grabouw under the leadership of municipal officials provided a platform from which to launch a formal empirical study that involved data collection strategies and processes. Appointments for individual interviews snowballed from the first interviews that were secured during this meeting.

All interviews followed the same pattern: (i) researcher's introduction; (ii) explanation of the purpose of the study; and (iii) clarification of basic terms such as CI and EA. The purposive sampling of participants assisted in applying snowballing sampling, and sometimes convenience sampling, to select other key participants for this research. Subsequent interviews took place at different locations in the community. In the end, thirty-three interviews, inclusive of a focus group session, were

concluded. The saturation of collected data and repetitive responses during interviews determined the number of participants interviewed, which was thirty-three (Appendices M & N).

Recorded audio transcripts were converted into text transcriptions (Appendices M & N). The transcriptions were then emailed to the participants for verification and validation of the content and meaning. Transcriptions were coded and re-coded, using ATLAS.ti, formulating categories in order to identify themes and sub-themes that responded to the research questions, (Figure 6.3).

Braun and Clarke (2006) argue that the process of thematic analysis requires clarity on the type of thematic analysis to be undertaken, and the claim that the researcher seeks to make. The following questions need to be asked by the researcher: Is the approach inductive, purely data-driven, or is it theoretical thematic analysis, driven by the researcher's theoretical interest or the research question(s)? Is the process essentialist/realist analysis or it is constructionist thematic analysis? In addition, is the approach level semantic, explicitly looking at the surface with respect to what the data are saying, or latent, looking deep into the ideas, assumptions or ideologies; in short, is the approach dealing with the interpretive level?

In this chapter, the researcher adopts the theoretical, constructionist and latent approach to thematic analysis.

The pragmatic approach adopted by the researcher in this chapter evolved into subsequent sections, as follows (Figure 6.1):

i) In section 6.2, the researcher presents the analysis of DSR sub-cycle 1.
ii) The analysis of DSR sub-cycle 2 is presented in section 6.3.
iii) In section 6.4, the researcher presents the analysis of DSR sub-cycle 3, which integrated the results of the analysis described in sections 6.2 and 6.3.
iv) In section 6.5, the researcher presents a thematic discussion of DSR sub-cycle 1, DSR sub-cycle 2 and DSR sub-cycle 3.
v) In section 6.6, the researcher discusses the development phase of the main cycle by building the EA4CD framework needed for implementing community-based ICT projects.
vi) In section 6.7, the researcher concludes the design chapter with a summary.

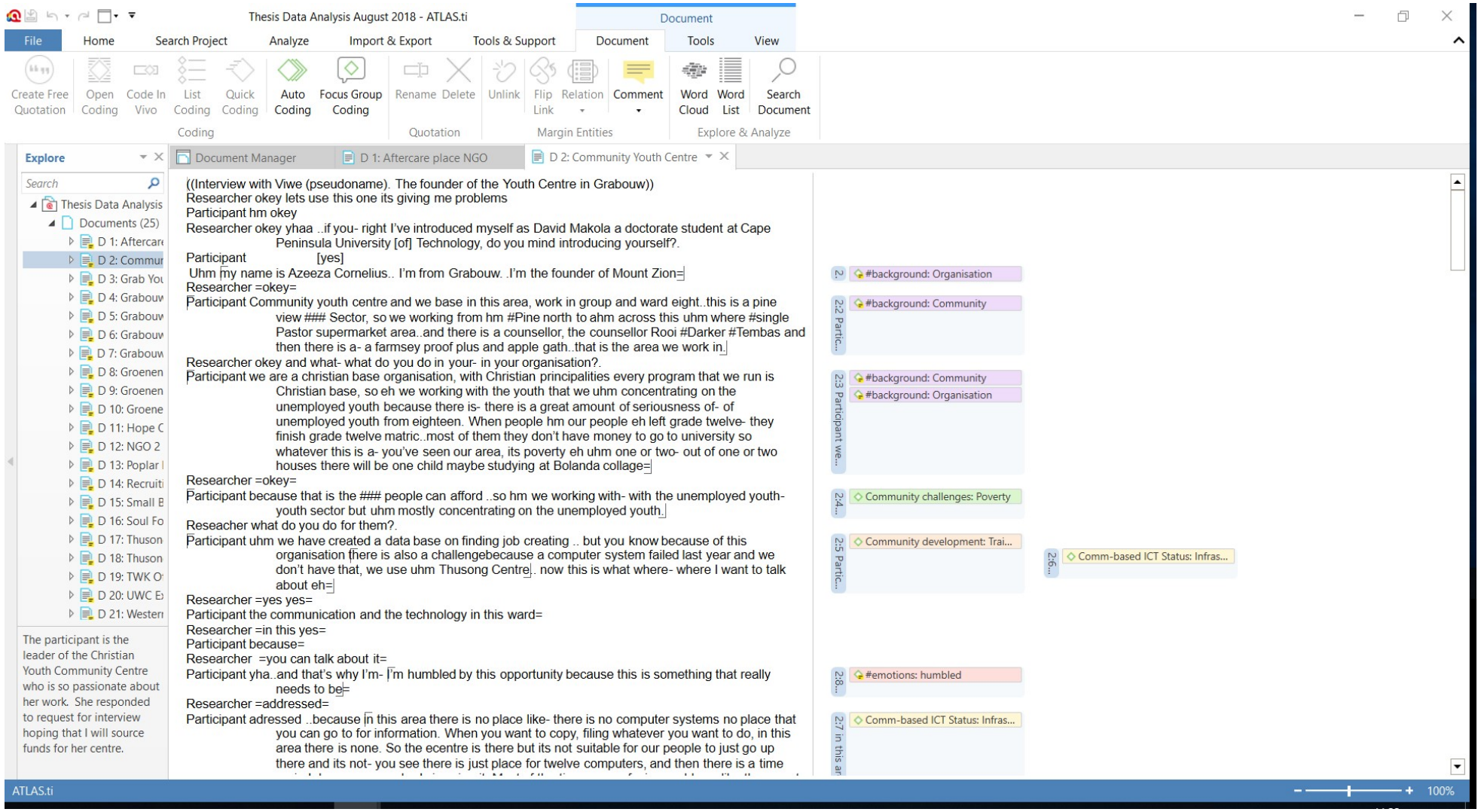

Figure 6.3: Screenshot for ATLAS.ti

6.2 Analysis of DSR sub-cycle 1

The process of analysis of the DSR sub-cycle 1 follows a three-phased DSR process: (i) awareness of the problem; (ii) suggestions; and the (iii) development phase (Vaishnavi & Kuechler, 2015:15) (Figure 6.4).

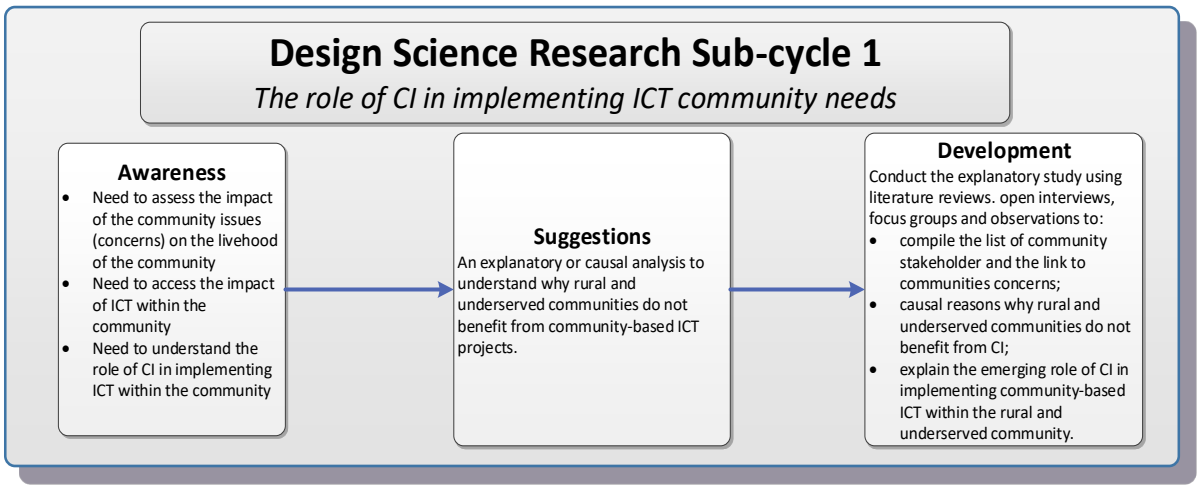

Figure 6.4: DSR sub-cycle 1
(Source: Vaishnavi & Kuechler, 2015:15)

6.2.1 The awareness phase

The awareness phase is captured in SRQ 1, which sought to explain why rural and underserved communities do not benefit from CI when implementing community-based ICT projects.

SRQ 1: Why are rural and underserved communities not benefiting from CI when implementing community-based ICT projects?

During the awareness phase of DSR sub-cycle 1, the researcher probed the analytic assessment of the impact of community concerns that affected the livelihood of the community. This phase determined the effect of community concerns on how CI could be embraced so as to impact positively on the use of ICT within the community.

6.2.2 The suggestion phase

The suggestion phase of DSR sub-cycle 1 provided the researcher with an opportunity to analyse the personal interviews in order to understand the role of ICT in addressing community concerns. Using the thematic analysis method, the researcher identified themes that demonstrated “patterns of meaning across a dataset that provide an answer to the research question being addressed” (Brady et al., 2019:19). The seminal article by Braun and Clarke (2006:6) outlines the six-

phased reflexive thematic analysis method, which provided the themes that responded to SRQ 1 (section 5.9.2.1).

6.2.3 The development phase

During the development phase of the DSR sub-cycle 1, the researcher applied data collection methods, such as semi-structured interviews (sub-section A) and a focus group (sub-section B), to present the emerging themes analytically.

6.2.3.1 A: Thematic analysis (TA) for individual interviews

Braun and Clarke's (2006) seminal article presents a six-phased approach to build explanatory themes from the data corpus.

Phase 1: Familiarisation with the data

The first phase involves transcribing the recorded interviews. The researcher read and re-read the data to understand what the participants were saying. This phase was tedious and time-consuming, but with the positive spin-off of understanding the data. The transcribed documents (example of transcription, Figure 6.5) were uploaded into the ATLAS.ti software package.

Phase 2: Creation of initial codes

In this phase, initial codes were formulated from the transcribed data. According to Braun and Clarke (2006), the researcher needs to decide whether the initial codes are created at the semantic or latent level. At the semantic thematic level, also known as the explicit level, codes are studies on surface, not looking further than what the data says. During the latent thematic level, on the other hand, the underlying ideas are identified, assumptions made and conceptualisation takes place (Ibid.). The latent level involves interpretivism, which operates in the constructionist paradigm, where the socio-cultural and structural conditions drive the process. Research questions also influence how codes are selected. The latent level assists to create explanatory and interpretive codes. The researcher operated on the latent level.

Meaningful codes were created from lines and lines, or paragraphs, of transcribed data. Miles and Huberman (1994) indicate that the coding process is part of the analysis. Constant comparative analysis of codes was a critical analytical process that led to category development in this research. Figure 6.5 illustrates an example of the initial coding process. In total, 179 codes were developed using ATLAS.ti. The 179 codes were reduced to 57 codes by combining codes with the same meaning (74 out of 179) and leaving out unrelated codes (48 out of 150). The 57 codes used are presented in Table 6.1.

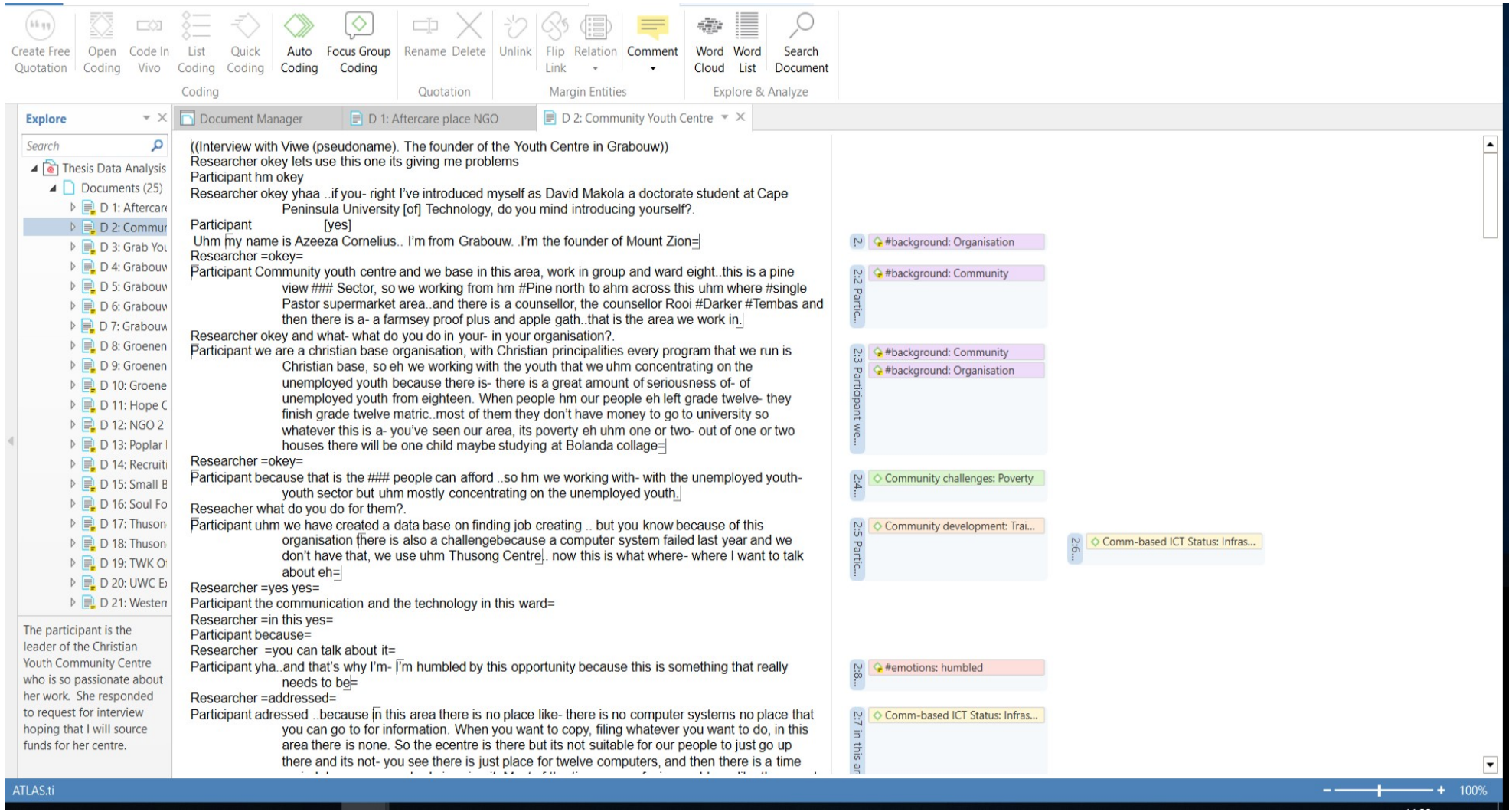

Figure 6.5: Initial coding for individual interviews

Table 6.1: Primary codes (57)

Codes		
e-Centre	Better communication	MTN
Free internet access	Employment seeking	Cell C
Access to information	Service delivery solutions	Hotspots
Poverty alleviation	Management tool	OTT apps
Lack of/poor Internet connection	Economic	Microsoft packages
High ISP costs	Exposure to local and international markets	e-Mail facilities
Generational gap	Exposure to different cultures	e-Business (ATMs, M-PESA, etc.)
Lack of resources	Travel and tourism	Tech-savvy
Community e-libraries	Communication	End-user computing skills
Community centres	Community development	Developers
Telecentres	Expensive devices	Network specialists
Government information	Expensive data costs	Programmers
Government service delivery	Rate of ICT changes	Project manager
Resources	Lack of ICT infrastructure	Web designers
ICT policies	Lack of ICT training	Database specialists
ICT tools	Current ICT infrastructure	ICT personnel
ICT collaboration	Broadband	Available Internet
Crime prevention	Internet	Available infrastructure
ICT education and training	Vodacom	ICT applications

Phase 3: Searching for categories and themes

The third phase called for a search of categories and themes, focusing on the 57 codes derived from phase 2. This phase was an iterative phase consisting of grouping similar codes; or changing or improving the categories of codes, as inspired by quotations attached to the codes. Fifteen categories were identified (Table 6.2).

Table 6.2: Primary codes (57) codes with categories (15)

Codes	Categories
e-Centre	**Access benefits**
Free Internet access	
Access to information	
Poverty alleviation	
Lack/poor of Internet connection	**Access challenges**
High ISP costs	
Generational gap	
Lack of resources	
Community e-libraries	**Access to information**
Community centres	

Codes	Categories
Telecentres	
Government information	
Government service delivery	
Resources	**Sustainable programs**
ICT policies	
ICT tools	
ICT collaboration	
Crime prevention	**Opportunities**
ICT education and training	
Better communication	
Employment seeking	
Service delivery solutions	
Management tool	
Economic	
Exposure to local and international markets	**Globalisation**
Exposure to different cultures	
Travel and tourism	
Communication	**Governance**
Community development	
Expensive devices	**Devices challenge**
Expensive data costs	
Rate of ICT changes	
Lack of ICT infrastructure	
Lack of ICT training	**Lack of information**
Current ICT infrastructure	**ICT infrastructure**
Broadband	
Internet	
Vodacom	**ISP**
MTN	
Cell C	
Hotspots	
OTT apps	**ICT applications**
Microsoft packages	
e-Mail facilities	
e-Business (ATMs, M-PESA, etc.)	
Tech-savvy	**ICT skills needed**
End-user computing skills	
Developers	
Network specialists	**ICT technical support**
Programmers	
Project manager	
Web designers	
Database specialists	

Codes	Categories
ICT personnel	**Inadequate ICT status**
Available Internet	
Available infrastructure	
ICT applications	

The researcher continued scrutinising the fifteen (15) categories, looking for similar categories, whether there were overlaps in categories that needed to be fixed, or whether there were any relationships between the categories. Five (5) sub-themes emerged from this iterative process as shown in Table 6.3.

Table 6.3: Primary codes (57) with categories (15) and sub-themes (5)

Codes	Categories	Sub-themes
e-Centre	Access benefits	**Access need**
Free internet access		
Access to information		
Poverty alleviation		
Lack/poor of Internet connection	Access challenges	
High ISP costs		
Generational gap		
Lack of resources		
Community e-libraries	Access to information	
Community centres		
Telecentres		
Government information		
Government service delivery		
Resources	Sustainable programs	**The required community ICT technical support**
ICT policies		
ICT tools		
ICT collaboration		
Crime prevention	Opportunities	
ICT education and training		
Better communication		
Employment seeking		
Service delivery solutions		
Management tool		
Economic		
Exposure to local and international markets	Globalisation	
Exposure to different cultures		
Travel and tourism		
Communication	Governance	
Community development		

Codes	Categories	Sub-themes
Expensive devices	Devices challenge	**The required community ICT operations**
Expensive data costs		
Rate of ICT changes		
Lack of ICT infrastructure		
Lack of ICT training	Lack of information	
Current ICT infrastructure	ICT infrastructure	
Broadband		
Internet		
Vodacom	ISP	
MTN		
Cell C		
Hotspots		
OTT apps	ICT applications	
Microsoft packages		
e-Mail facilities		
e-Business (ATMs, M-PESA, etc.)		
Tech-savvy	ICT skills needed	**Community ICT needs**
End-user computing skills		
Developers		
Network specialists	ICT technical support	
Programmers		
Project manager		
Web designers		
Database specialists		
ICT personnel	Inadequate ICT status	**The current ICT status**
Available Internet		
Available infrastructure		
ICT applications		

The process continued with the same vigour and scrutiny, as was the case with categories and sub-themes; however, this time, theme search was the major activity.

Two themes, as shown in Table 6.4, were the final result of this search.

Table 6.4: Primary codes (57) with categories (15), sub-themes (5) and themes (2)

ICT in the community			
Codes	**Categories**	**Sub-Themes**	**Themes**
e-Centre	Access benefits	Access need	**The need for stable technology and infrastructure**
Free internet access			
Access to information			
Poverty alleviation			
Lack/poor of Internet connection	Access challenges		
High ISP costs			
Generational gap			
Lack of resources			
Community e-libraries	Access to information		
Community centres			
Telecentres			
Government information			
Government service delivery			
Resources	Sustainable programs	The required community ICT technical support	
ICT policies			
ICT tools			
ICT collaboration			
Crime prevention	Opportunities		
ICT education and training			
Better communication			
Employment seeking			
Service delivery solutions			
Management tool			
Economic			
Exposure to local and international markets	Globalisation		
Exposure to different cultures			
Travel and tourism			
Communication	Governance		
Community development			
Expensive devices	Devices challenge	The required community ICT operations	
Expensive data costs			
Rate of ICT changes			
Lack of ICT infrastructure			
Lack of ICT training	Lack of information		
Current ICT infrastructure	ICT infrastructure		
Broadband			
Internet			
Vodacom	ISP		
MTN			
Cell C			
Hotspots			

ICT in the community			
Codes	**Categories**	**Sub-Themes**	**Themes**
OTT apps	ICT applications		
Microsoft packages			
e-Mail facilities			
e-Business (ATMs, M-PESA, etc.)			
Tech-savvy	ICT skills needed	Community ICT needs	**The need for education and skills training**
End-user computing skills			
Developers			
Network specialists	ICT technical support		
Programmers			
Project manager			
Web designers			
Database specialists			
ICT Personnel	Inadequate ICT status	The current ICT status	
Available Internet			
Available infrastructure			
ICT applications			

Phase 4: Reviewing potential themes

Once the candidates' themes were established (Table 6.4), the quality review process started. In this process, the researcher reviewed the themes to ensure that data co-existed in a meaningful way. Braun and Clarke (2006) suggest that a review of candidate themes should be done at two levels. The first level requires the researcher to read all excerpts linked to the particular theme to ascertain whether coherency and structure are established. If not, the researcher should find where the problem was and correct it. The second level takes the review to the higher level, where themes are reviewed in context of the whole data set. This process captures any codes that might have been linked erroneously or omitted by mistake. After scrutinising the themes and the entire data set, the researcher found no erroneously or omitted codes.

The outcome of the review assisted in formulating a thematic map, shown in Figure 6.6.

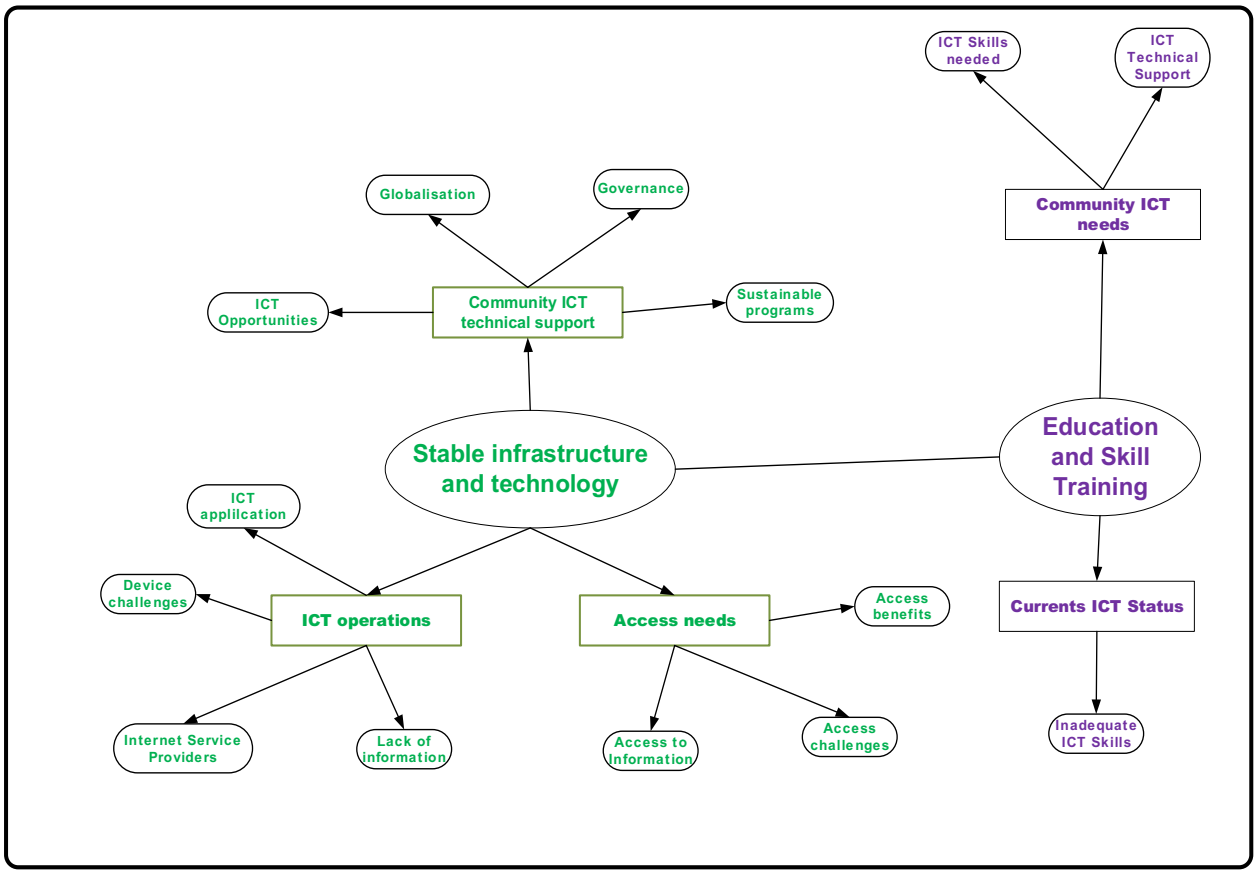

Figure 6.6: Developed a thematic map showing the two themes

Phase 5: Defining and naming themes

The purpose of Phase 5, unlike the reviews done in Phase 4, is for the researcher to explain the reason for the existence of each theme, reveal the aspects of the data that were captured, and explain why each theme exists. According to Braun and Clarke (2006:92), this phase identifies the 'essence' of each theme. During this phase, the researcher briefly defined the focus, scope and purpose of each theme and ascertained whether other themes could be developed from the current theme. A detailed account of the thematic discussion is presented in Section 6.5.

Theme 1: The need for a stable infrastructure and technology

Participants viewed the need for the stable ICT Infrastructure and technology as a focus area for community development. They argued that community-based ICT projects were bound to fail unless the ICT infrastructure and the technology that host these projects were reliable. The participants responded that the rural and underserved community could develop better with stable ICT infrastructure and technology to depend on. The scope of the theme was based on the availability of community ICT technical support, community ICT operations and seamless access to technology, which were identified as sub-themes (Figure 6.7).

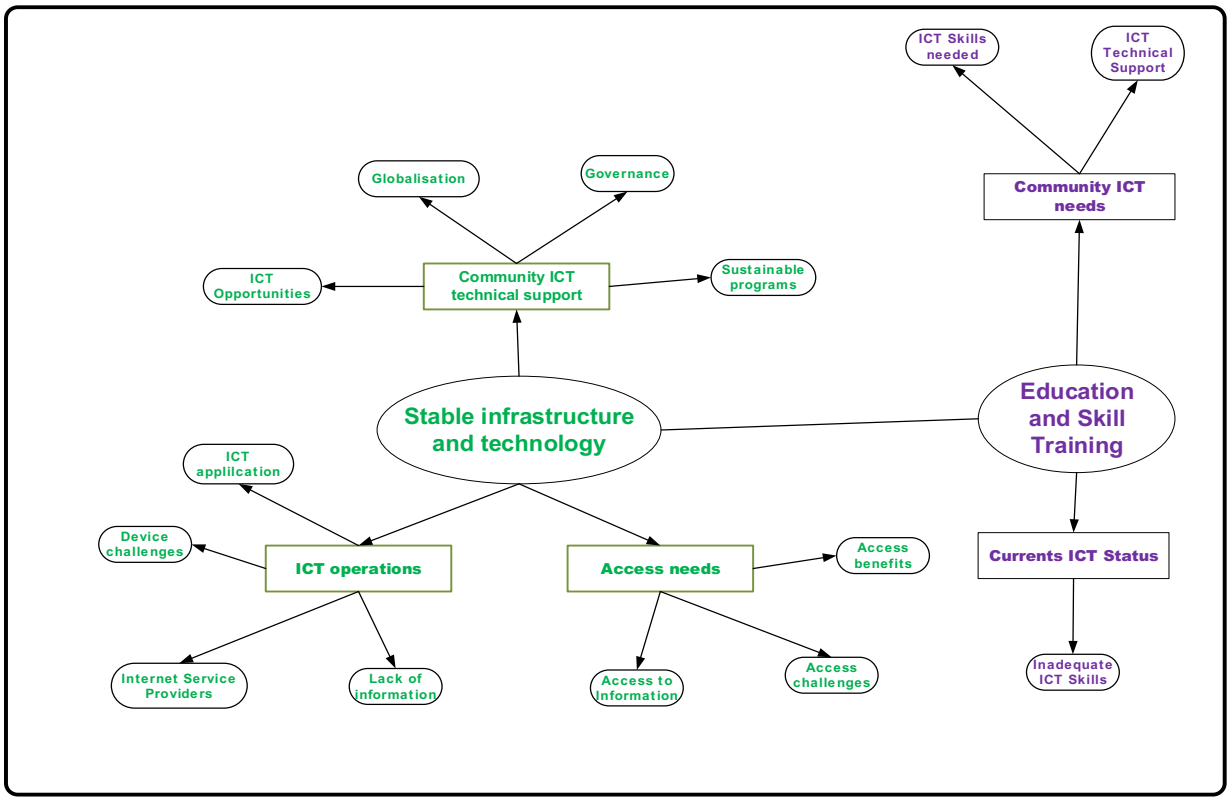

Figure 6.7: Developed a thematic map showing the two themes

The purpose of the theme was to unveil the reasons why the infrastructure was unreliable and dysfunctional.

Theme 2: The need for ICT education and ICT skills training

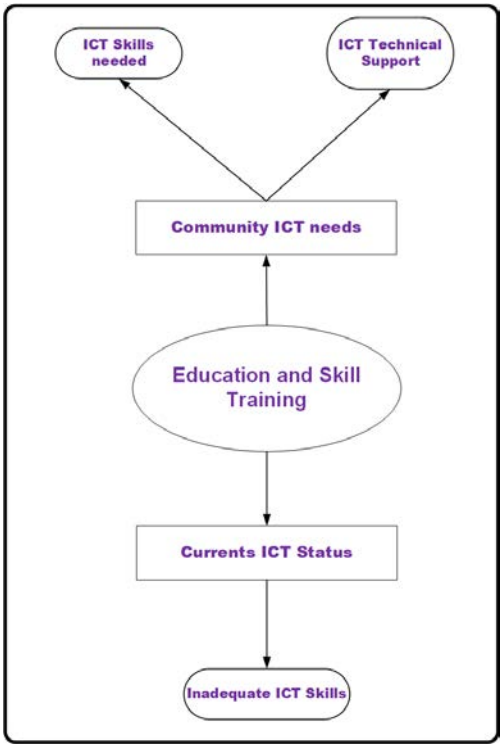

Figure 6.8: Thematic map for education and skills training

This theme demonstrated the need for ICT education and ICT skills training, as well as exposure tp technology as a means of ensuring community development. The focus was on education and skills development for the community. The scope within the theme was to understand the current ICT status, which would determine what education and training the community required. It further covered what ICT skills and technical support were needed (Figure 6.8).

Phase 6: Producing the report

Braun and Clarke (2006:93) argue that the report provides critical evidence of the themes, supported by data. The final comprehensive report is discussed in section 6.5.

6.2.3.2 B: Thematic analysis (TA) for focus group

The focus group analysis followed the six-phased thematic analysis process of Braun and Clarke (2006), undertaken with the individual interviews.

Phase 1: Familiarisation with the data

The first phase involved reading and transcribing the recorded focus group session, as was done with individual interviews.

Phase 2: Creation of initial codes

In this phase, the transcribed data were studied at the latent level, as opposed to the semantic level, as explained by Braun and Clarke (2006). The latent level identified the underlying ideas, assumptions and conceptualisation using the interpretivist approach, considering the research questions that largely influenced how codes were selected. This process yielded 110 codes, which are presented in Table 6.5.

Table 6.5: Codes table (110)

Codes		
Self-employed	Safety and security	Identity of human capital
NGO/Aftercare managers	Ubuntu/Batho pele	Vision and mission
Municipal official	Interpersonal skills	Increase productivity
Employed	Accountability	Better facilities of learning
Unemployed adult	Influential	Better facilities of health
Unemployed youth	Problem-solving skills	Better roads
Learner	Financial security	Successful community projects
School-leaver	Stable jobs	Family successes
Trained skill	Empowering women	Reduced unemployment rate
Educator	Parochial attitude	Reduced crime
Police	Generational gap	Better housing
Nurse	Gate-keepers	Better service delivery

Codes		
Community/civic leaders	Social cohesion	Successful businesses
Church leader	Social programs	Exporting goods to global markets
Principal	Use of local resources	Highly recognised professionals
NGO manager	Changing labour markets	Better throughput rate of matriculants (Grade 12s)
Political organisation leader	Unemployment	Better level of professionals
Driver	Education	Higher skills available
Farm worker	Health	Regular stakeholder meetings
Hair dresser	Urbanisation	Functioning School Boards
Employment agent	Discrimination	Regular community social gatherings
Aftercare teacher	Influx of immigrants	Regular church meetings
Taxi owner	Home ownership	Functioning workers union
Carpenter	Environment	Active politics
Domestic worker	Delegate authority	People responsibility
Ward councillors	Accountability	Community involvement
Municipality officials	Shack dwellers	Community achievements/ success
Religious leaders	Community participation	Community volunteering
Political organisation	Community goals	Organisational stability
Big business	Good governance	Community buy-in
Small business	Respect for human rights	Public involvement
Wards	Active participation	Western Cape Government officials
Municipality	Judicial use of resources	District officials (government)
Provincial government	Protection of community assets	Municipality officials
National government	Environmental stewardship	Academics
Combating crime	Trust	Professionals
Service delivery: electricity, water, roads and sanitation	Substance abuse	

Phase 3: Searching for categories and themes

In the third phase, the search for categories and themes from the initial 110 codes continued. This iterative phase involved changing or improving the search for better categories of codes, as inspired by the quotations attached to the codes. Similarities or overlaps of categories were dealt with.

The outcome of the analysis of categories is presented in Table 6.6, where twenty (26) categories are indicated.

Table 6.6: Codes (110) and categories (26)

Codes	Categories
Self-employed	**Employment status**
NGO/aftercare managers	
Municipal official	
Employed	
Unemployed adult	
Unemployed youth	
Learner	**Educational background**
School-leaver	
Trained skill	
Educator	
Police	
Nurse	
Community/civic leaders	**Community leadership background**
Church leader	
Principal	
NGO manager	
Political organisation leader	
Driver	**Skills audit**
Farm worker	
Hair dresser	
Employment agent	
Aftercare teacher	
Taxi owner	
Carpenter	
Domestic worker	
Ward councillors	**Political leaders**
Municipality officials	
Religious leaders	
Political organisation	
Big business	**Private sector**
Small business	
Wards	**Government**
Municipality	
Provincial government	
National government	
Combating crime	**Human basic needs**
Substance abuse	
Service delivery: electricity, water, roads and sanitation	
Trust	
safety and security	

Codes	Categories
Ubuntu/Batho pele	**Need for dedicated leaders**
Interpersonal skills	
Accountability	
Influential	
Problem-solving skills	
Financial security	**Need for economic empowerment**
Stable jobs	
Empowering women	
Parochial attitude	
Generational gap	
Gate-keepers	**Need for social inclusion**
Social cohesion	
Social programs	
Use of local resources	
Changing labour markets	**Changing demographics**
Unemployment	
Education	
Health	
Urbanisation	
Discrimination	
Influx of immigrants	
Home ownership	**Sense of owning a place**
Environment	
Delegate authority	
Accountability	
Shack dwellers	
Community participation	**Responsibility**
Community goals	
Good governance	
Respect for human rights	
Active participation	
Judicial use of resources	**Stewardship**
Protection of community assets	
Environmental stewardship	
Identity of human capital	
Vision and mission	**Community goals**
Increase productivity	
Better facilities of learning	
Better facilities of health	
Better roads	
Successful community projects	**Community advancement**
Family successes	
Reduced unemployment rate	
Reduced crime	

Codes	Categories
Better housing	
Better service delivery	
Successful businesses	**Community recognition**
Exporting goods to global markets	
highly recognised professionals	
Better throughput rate of matriculants (Grade 12s)	
Better level of professionals	
Higher skills available	
Regular stakeholder's meeting	**Sustainable development**
Functioning school boards	
Regular community social gatherings	
Regular church meetings	
Functioning workers union	
Active politics	
People responsibility	
Community involvement	
Community achievements/success	
Community volunteering	
Organisational stability	
Community buy-in	
Public involvement	**Community stakeholders**
Western Cape Government officials	
District officials (government)	
Municipality officials	
Academics	
Professionals	

The process of searching for themes followed the same process followed when searching for the 26 categories. In this instance, the search process identified themes from categories. Categories seamlessly led into themes, thus omitting sub-themes. The result of this phase is the presentation of six (6) themes in Table 6.7.

Table 6.7: Codes (110), categories (26) and themes (6)

Codes	Categories	Themes
Self-employed	Employment status	**Community background**
NGO/Aftercare managers		
Municipal official		
Employed		
Unemployed adult		
Unemployed youth		

Codes	Categories	Themes
Learner	Educational background	
School-leaver		
Trained skill		
Educator		
Police		
Nurse		
Community/civic leaders	Community leadership background	
Church leader		
Principal		
NGO manager		
Political organisation leader		
Driver	Skills audit	**Leadership**
Farm worker		
Hair dresser		
Employment agent		
Aftercare teacher		
Taxi owner		
Carpenter		
Domestic worker		
Ward councillors	Political leaders	
Municipality officials		
Religious leaders		
Political Organisation		
Big business	Private sector	
Small business		
Wards	Government	
Municipality		
Provincial government		
National government		
Combating crime	Human basic needs	**Rural community needs**
Substance abuse		
Service delivery: electricity, water, roads and sanitation		
Trust		
Safety and security		
Ubuntu/Batho pele	Need for dedicated leaders	
Interpersonal skills		
Accountability		
Influential		
Problem-solving skills		

Codes	Categories	Themes
Financial security	Need for economic empowerment	
Stable jobs		
Empowering women		
Parochial attitude		
Generational gap		
Gate-keepers	Need for social inclusion	
Social cohesion		
Social programs		
Use of local resources		
Changing labour markets	Changing demographics	
Unemployment		
Education		
Health		
Urbanisation		
Discrimination		
Influx of immigrants		
Home ownership	Sense of owning a place	**Ownership**
Environment		
Delegate authority		
Accountability		
Shack dwellers		
Community participation	Responsibility	
Community goals		
Good governance		
Respect for human rights		
Active participation		
Judicial use of resources	Stewardship	
Protection of community assets		
Environmental stewardship		
Identity of human capital		
Vision and mission	Community goals	**Motivation**
Increase productivity		
Better facilities of learning		
Better facilities of health		
Better roads		
Successful community projects	Community advancement	
Family successes		
Reduced unemployment rate		
Reduced crime		
Better housing		
Better service delivery		
Successful businesses	Community recognition	

Codes	Categories	Themes
Exporting goods to global markets		
Highly recognised professionals		
The better throughput rate of matriculants (Grade 12s)		
Better level of professionals		
Higher skills available		
Stakeholder meetings	Sustainable development	**Community sustainable relationships**
Functioning School Boards		
Regular community social gatherings		
Regular church meetings		
Functioning workers union		
Active politics		
People responsibility		
Community involvement		
Community achievements/success		
Community volunteering		
Organisational stability		
Community buy-in		
Public involvement	Community stakeholders	
Western Cape Government officials		
District officials (government)		
Municipality officials		
Academics		
Professionals		

Phase 4: Reviewing potential themes

The themes identified in phase 3 were reviewed and refined on two levels. The first level review focused on the researcher reading, re-reading and then reviewing quotations linked codes, the grouping of quotations linked to the category, and by extension, led to the themes that needed to be established if the individual themes were coherent and meaningful. The second level review extended the review of themes to the whole data set, capturing any codes that may have been erroneously linked or omitted by mistake. The outcome of the review rectified and stabilised the main thematic map for the focus group, as presented in Figure 6.9.

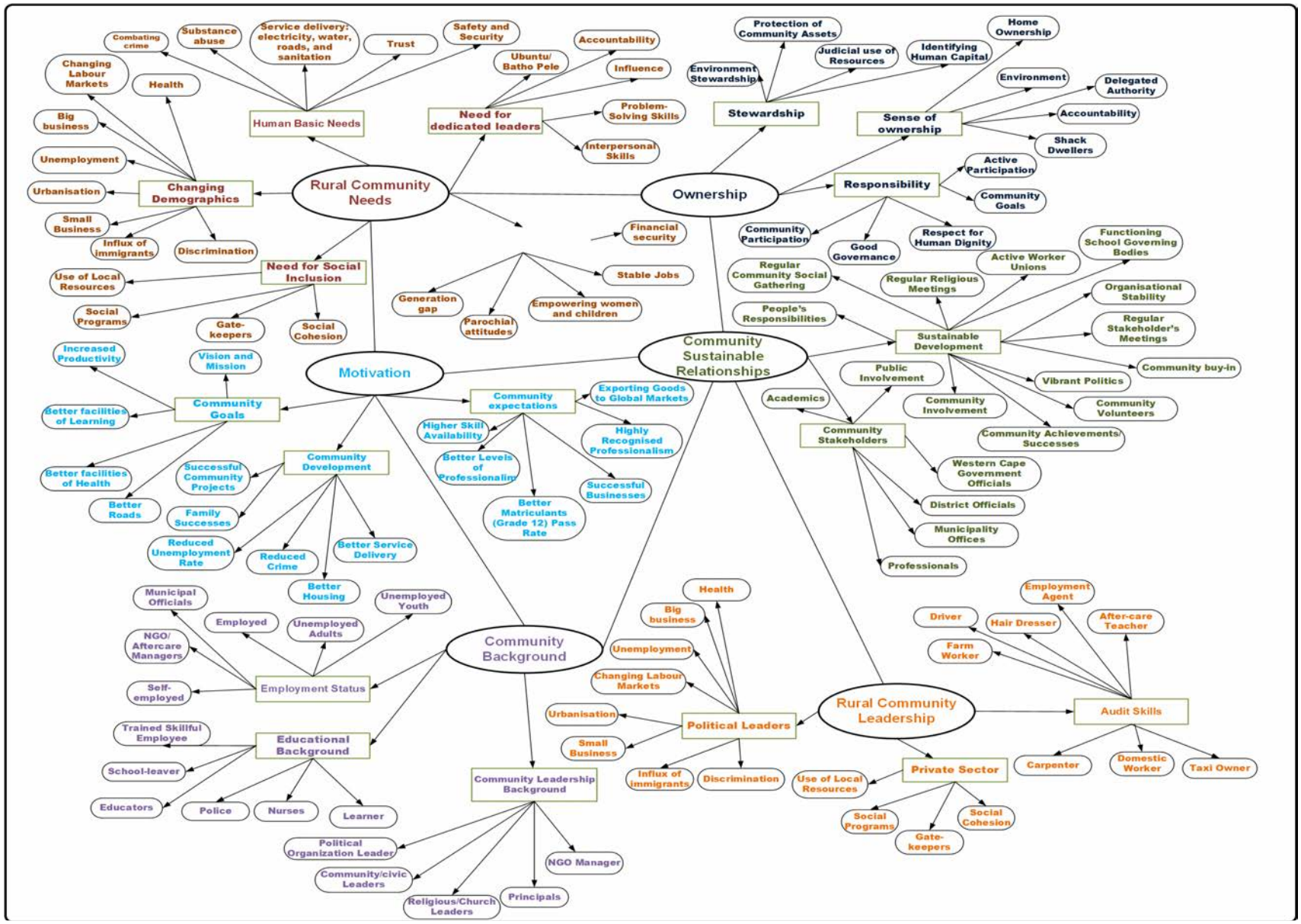

Figure 6.9: The main thematic map for the focus group

Phase 5: Defining and naming themes

In phase 5, the essence of the themes was highlighted. An in-depth discussion of the themes follows in section 6.5.

Theme 1: The understanding of the community background

Three categories form part of this theme, as shown in Figure 6.10. Firstly, the educational background of the community featured as a critical category, since it demonstrated what the possibility for community participation in the development of ICT within the community was.

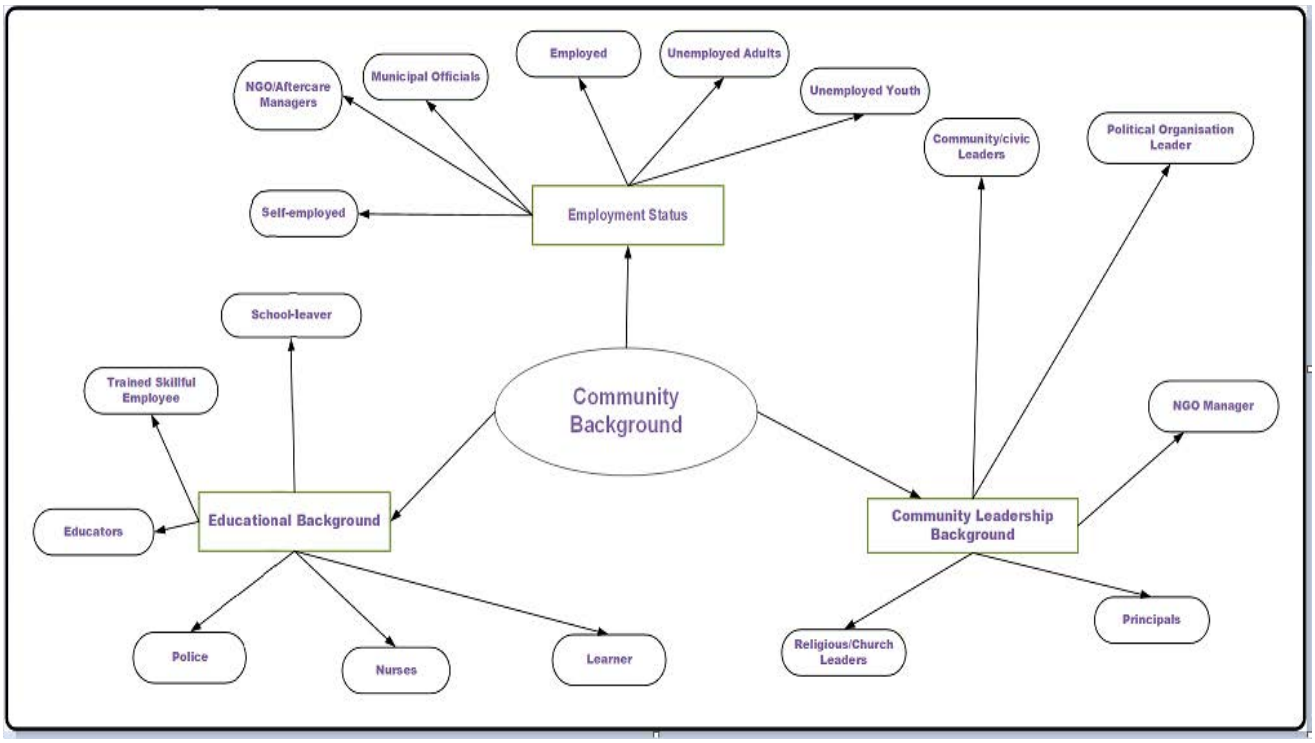

Figure 6.10: Thematic map for community background

The second category dealt with the current employment status of individuals within the community. The third category dealing with the community background was community leadership. The three categories set out the scope and the boundaries of the first theme. Through this theme, the researcher sought to understand the current background of members of the community that affected community development.

Theme 2: The need for rural community leadership

The focus of this theme was to identify community leaders who could affect the community positively. Three categories set the boundary of the theme: (i) skills audit; (ii) political leaders; and (iii) private sector participation. Although this theme linked well with Theme 1, it was crucial to state the needs that emerged for steadfast community leadership (Figure 6.11).

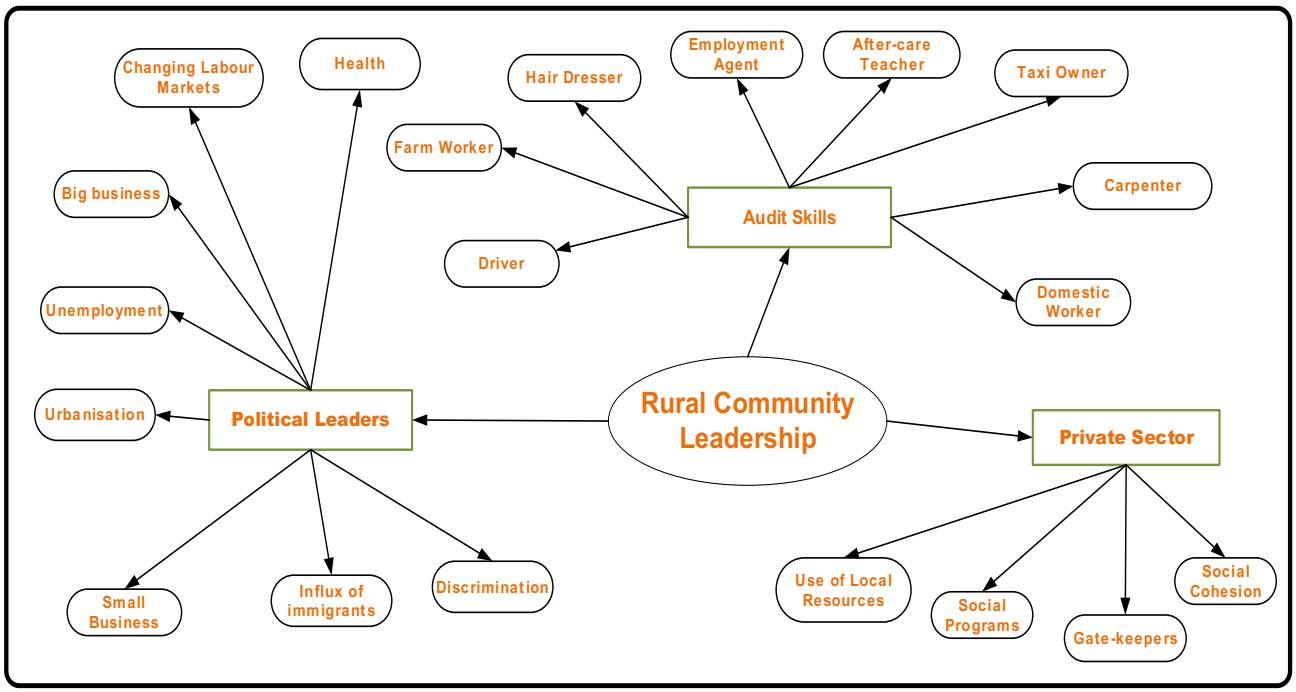

Figure 6.11: Thematic map for rural community leadership

Theme 3: The rural community needs

The third theme's focus was on the community needs. These included needs that would determine how one could improve the current situation for future, and possibly better, conditions. The theme encapsulated the consideration of basic human needs, namely, the need for dedicated leaders, the need for economic development, the need for social inclusion and the reality of changing demographics (Figure 6.12).

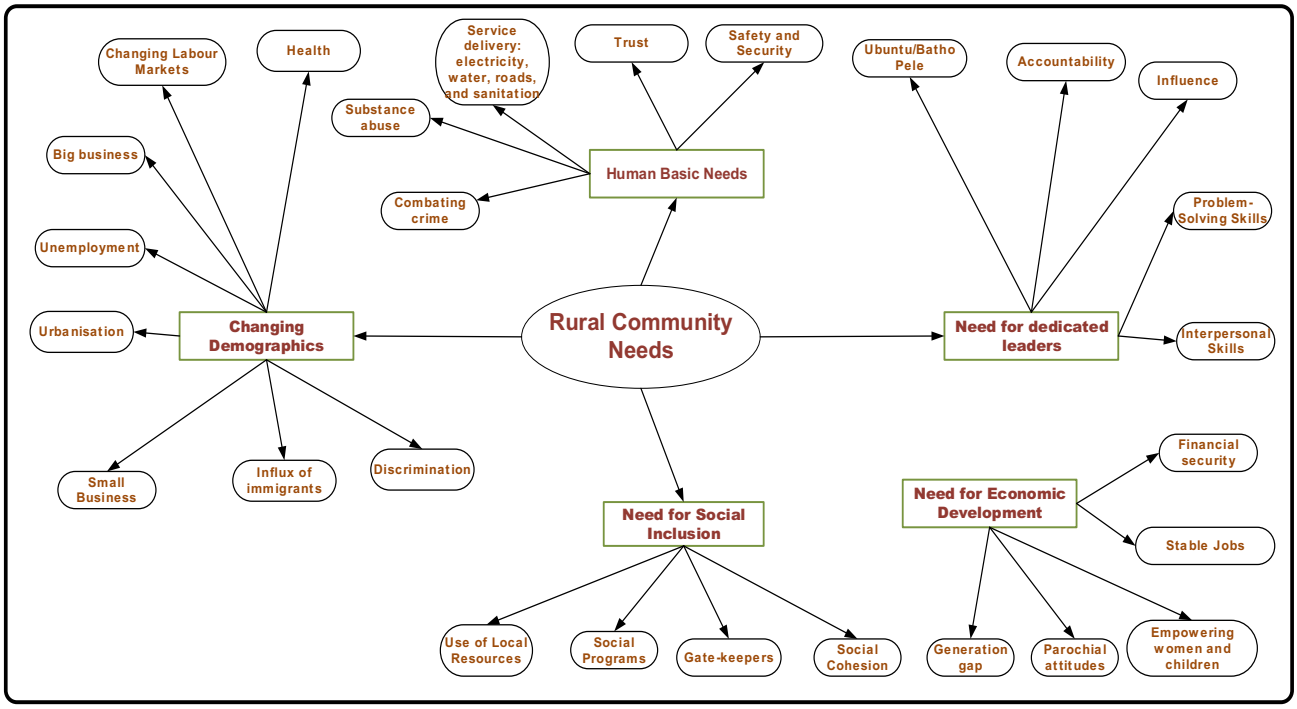

Figure 6.12: Thematic map for rural community needs

Theme 4: The need for ownership

The focus of theme 4 was on the need for ownership. The theme's boundary was set with respect to proper stewardship, responsibility and a sense of ownership (Figure 6.13).

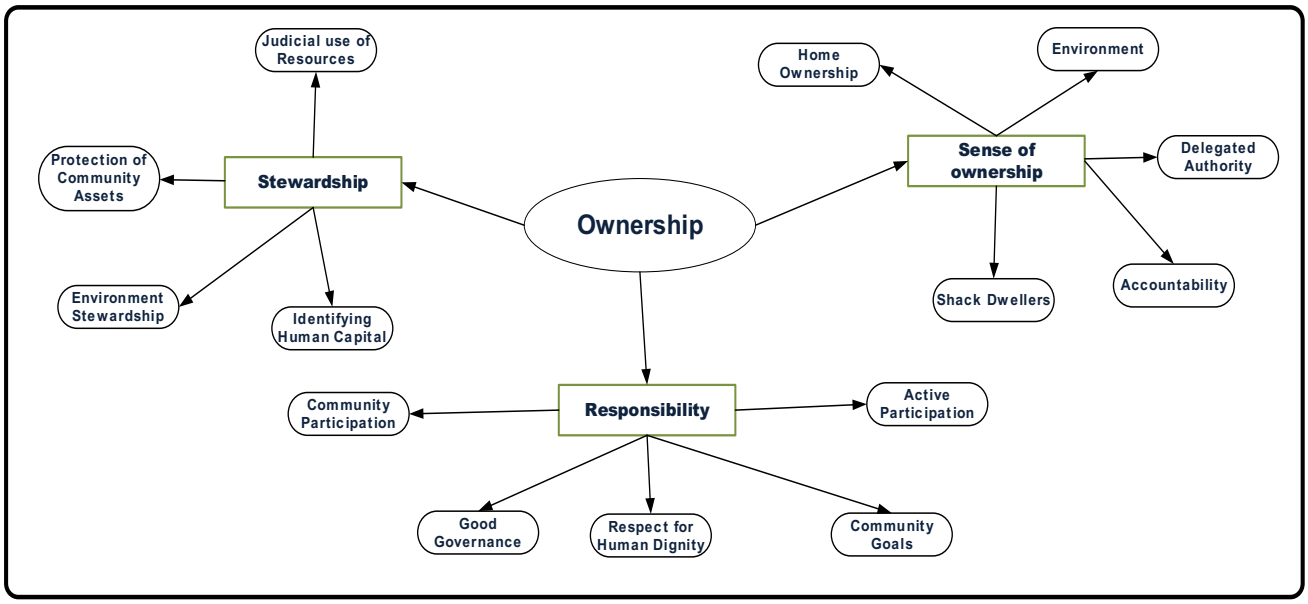

Figure 6.13: Thematic map for community ownership

Theme 5: The need for motivation

Theme 5 focused on community motivation. Figure 6.14 shows the categories, such as community goals, community development and community expectations, deemed necessary ingredients to motivate the community.

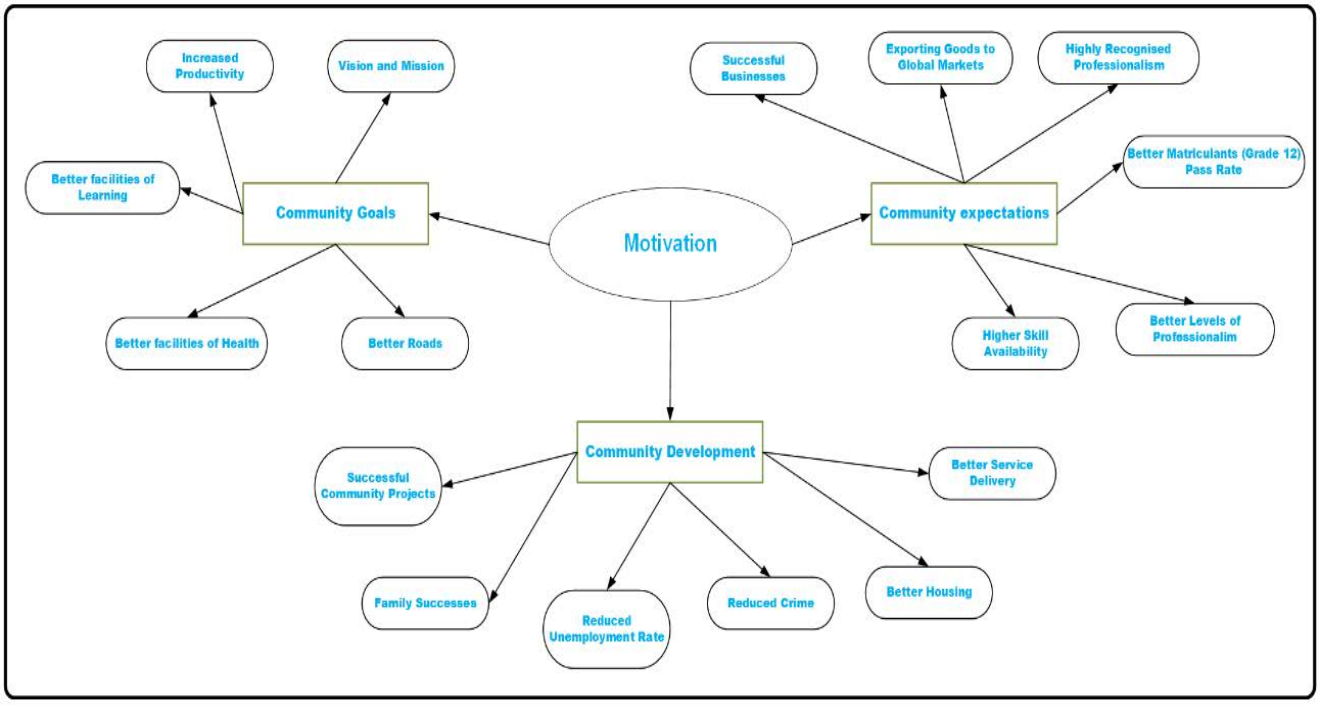

Figure 6.14: Thematic map for community motivation

Theme 6: The rural community sustainable relationships

Theme 6's focus was on a successful venture, where sustainability would become critical. Figure 6.15 demonstrates that sustainable development and community stakeholders are key to bringing about an improvement in the lives of community members.

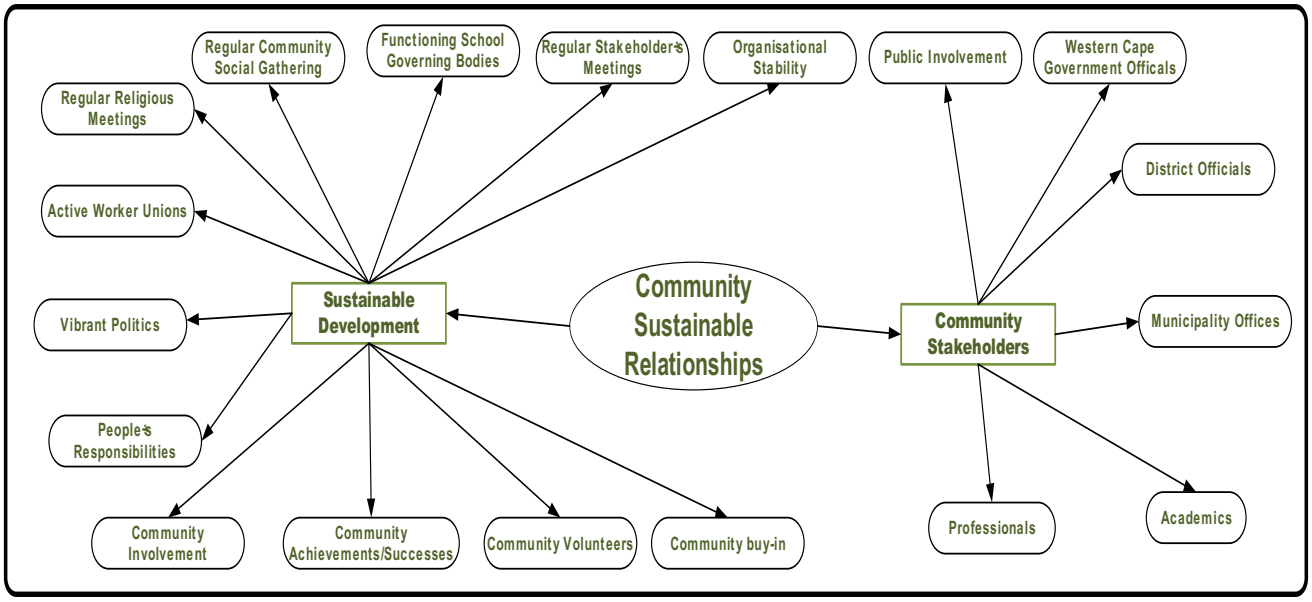

Figure 6.15: Thematic map for sustainable community relationships

Phase 6: Producing the report

Braun and Clarke (2006:93) argue that the report provides critical evidence of the themes, supported by the data. The final comprehensive report on the thematic analysis is discussed in section 6.5.

6.3 Analysis of DSR sub-cycle 2

The South African government is the custodian of the service delivery programmes in all communities (Bohler-Muller et al., 2016). The sub-research question posed in this study explored the government's EA role in assisting rural and underserved communities to implement community-based ICT projects.

SRQ 2: What is the role of government EA in implementing community-based ICT projects?

Sub-research question (SRQ 2) is illustrated in the conceptual framework in Figure 6.16. In this section, the researcher applied exploratory thematic analysis to respond to the SRQ 2. Kumar (2012:336) explains that the core objective of the explorative thematic analysis is "to explore an area where little is known or to investigate the possibilities of undertaking a particular research study".

In section 2.5.2 of the SLR, the researcher showed that there was little or no research done on the application of EA in rural and underserved communities.

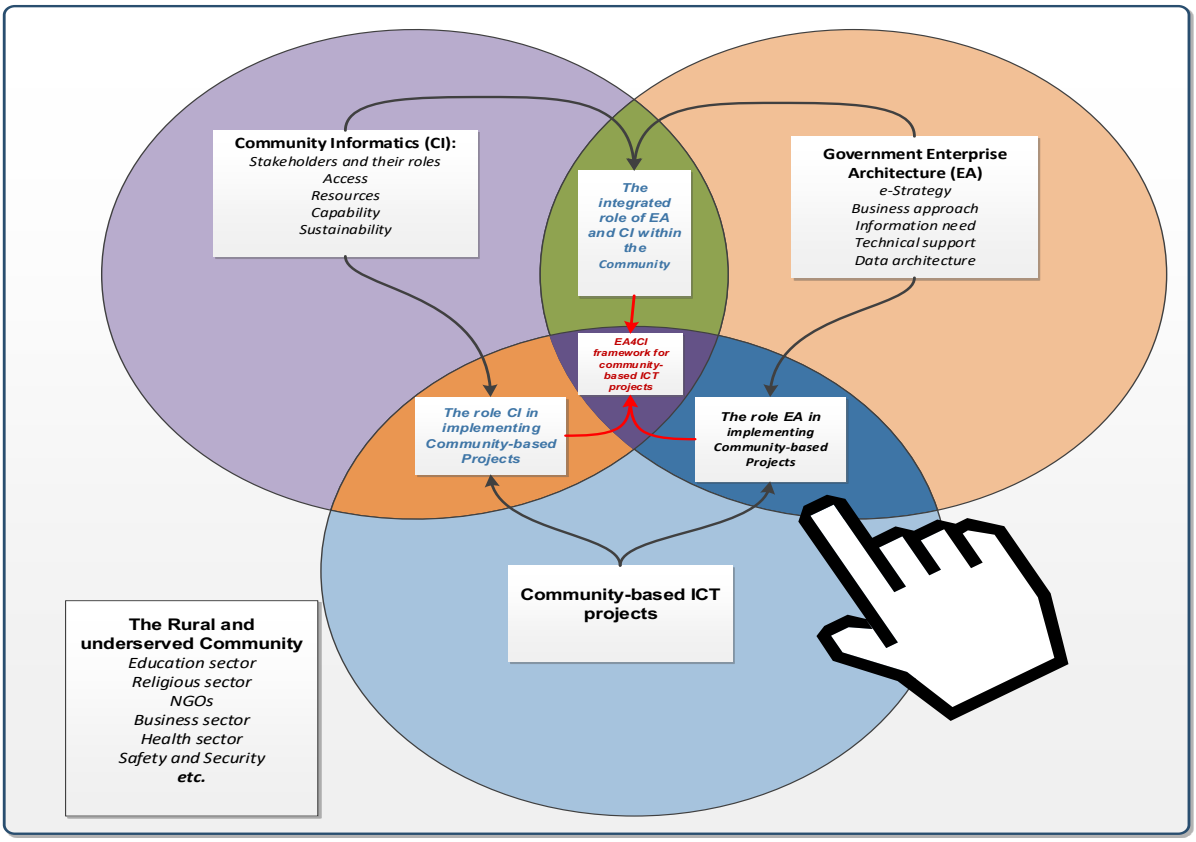

Figure 6.16: Conceptual framework: The role of government EA

The process of DSR sub-cycle 2 analysis was a three-phased DSR process, as presented in section 5.11 (Vaishnavi & Kuechler, 2015), and in DSR sub-cycle 1 in section 6.2. The three phases are: (i) awareness; (ii) suggestion; (iii) development (Figure 6.17).

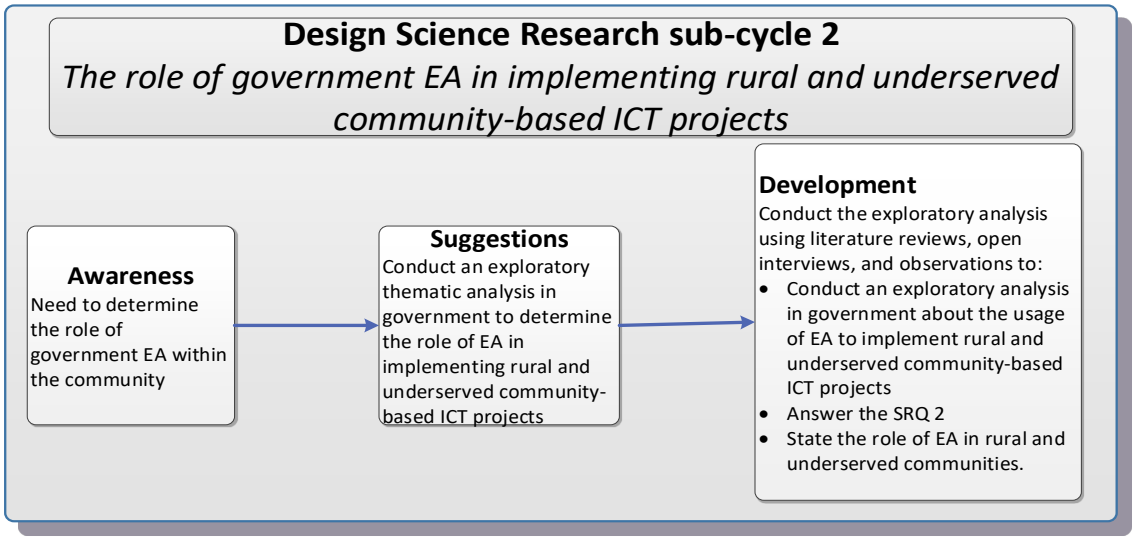

Figure 6.17: Design science research sub-cycle 2

6.3.1 The awareness phase

The awareness phase entails the need to understand the research problem in DSR sub-cycle 2. The problem is that the government's EA does not implement community-based ICT projects in rural and underserved communities, as is discussed in section 2.5.2. The triple challenge of poverty, unemployment and inequality, which features predominantly in rural and underserved communities, stifles growth and development. There is a need for stringent and a well-coordinated government activity that addresses this triple challenge by the carrying out of its service delivery duties to all of its citizens, including those in rural and underserved communities. The need to explore how government's EA can fulfil this role is crucial. Such exploration leads to the development of implementation strategies, which highlight the importance of citizens participating and collaborating in community development.

6.3.2 The suggestion phase

The suggestion phase proposes explorative thematic analysis be undertaken to understand the role of the government's EA in encouraging community development by implementing community-based ICT projects. Through this exploratory thematic analytical step of the study, the government's EA with respect to rural and underserved communities was uncovered. Explorative thematic analysis is flexible and provides a seamless way to access data (Braun & Clarke, 2019).

6.3.3 The developmental phase

The developmental phase includes the application of the explorative analysis research methods, namely, open-ended interview questions mainly posed to the WCG government officials, with the aim of gaining insights into how the government's EA considers the rural and underserved communities. The interview protocol explored the role of EA within communities (Appendix G). Guided by the theoretical lens of PDT (section 3.7), the researcher sought to understand the extent of community participation, their capabilities, their stakeholders, and the sustainability issues faced by government programmes. The emphasis was on a holistic view of the government's EA. one that does not neglect the rural and underserved community within its implementation. The government's EA strategy flowed from the perceptions of the people interviewed, from government documentation, from observations and from field notes. Through purposive and snowball sampling, five experts, comprising four senior WCG IT officials (three provincial government ICT officials and one municipal IT official) and an academic expert, were requested to respond to the semi-structured interviews.

This section follows Braun and Clarke's (2006) six-phases of discussed in section 5.9.2. The explorative thematic analysis aimed to understand the role of government's EA in seamlessly working with community-based ICT projects in rural and underserved communities designed to provide much-needed resources and services. The application of government's EA in rural and underserved communities is little known, hence, this study investigated the possibility of applying government's EA strategies to the implementation of community-based ICT projects. The purpose of this part of the study was therefore to extract the salient critical factors required to define the role of government's EA in implementing community-based ICT projects in rural and underserved communities.

Phase 1: Familiarisation with the data

Transcriptions of the information provided by the WCG officials and an EA expert academic were read and re-read so as to get a better understanding of their responses and to capture common, similar or contrasting concepts.

Phase 2: Creation of initial codes

The process of reading and marking codes yielded 106 initial codes (Table 6.8).

Table 6.8: Codes for EA (106)

Codes	Codes
National government	EA literature
Provincial government	EA historical origins
District municipalities	EA benefits
Sector level (e.g. health sector)	EA challenges
Institutional level	EA successes
Rural	EA implementation
Urban	EA evaluation
Semi-urban	Scope of EA
Underserved communities	Description of an organisation
Big Business	Organisational
Small Business	Semantic
Informal Business	Technical
Federal enterprises	Interoperability framework
Government-wide EA	Distributed computing
TOGAF	Product data exchange
Zachman framework	Electronic data exchange
Gartner	System connection
GERAM	Decision-making
EA management	Organisation barriers
EA modeling	Alignment
EA strategy	Business architecture principles

Codes	Codes
EA integration	Business process model
Project and program management	Goals and objectives
Assessment and evaluation	EA Policy
Change process	Business process management
Skilled team	Services delivery mode
Training and education	Service support
Commitment	Application architecture principles
Communication	Enterprise system
Holistic view	Logical application
Architectural analysis	Enterprise portal
Architectural models	Telecentres (Self-service)
Planning	Telemedicine
Current state	Data management
Future state	Technical architecture principles
Performance	Shared infrastructure
Consistency	Hardware components
Flexibility	Software
Language	Security service
Managing change	Target architecture
Top management	Community needs
Organisational culture	Desires
EA artefacts	Abilities
IS planning	Methods
Project Manager	Organisation systems
Chief Executive Officer	Labelling systems
Chief Operations Officer	Navigation systems
Application Engineer	Information exchange
Data architecture	Search systems
Infrastructure Architect	Quality
EA academics	Availability
EA practitioners	EA definitions

Phase 3: Searching for categories and themes

Through an iterative process, the 106 codes linked to extracts from the data sources provided grounds on which to search for and compile categories, themes and sub-themes, as shown in Table 6.9 (code and categories), Table 6.10 (codes, categories and sub-themes) and Table 6.11 (codes, categories, sub-themes and themes).

Table 6.9: EA Codes (106) and categories (16)

EA Codes	Categories
National government	**Public Administration**
Provincial government	
District municipalities	
Sector level (e.g. health sector)	
Institutional level	
Rural	**Citizens**
Urban	
Semi-urban	
Underserved communities	
Big businesses	**Private Sector**
Small business	
Informal business	
Federal enterprises	**EA Frameworks**
Government-wide EA	
TOGAF	
Zachman framework	
Gartner	
GERAM	
EA management	**Governance**
EA modeling	
EA strategy	
EA integration	
Project and program management	
Assessment and evaluation	
Change process	
Skilled team	**Team Capability**
Training and education	
Commitment	
Communication	
Holistic view	**EA Planning**
Architectural analysis	
Architectural models	
Planning	
Current state	
Future state	
Performance	
Consistency	
Flexibility	
Language	
Managing change	

EA Codes	Categories
Top management	
Organisational culture	
EA artefacts	
IS planning	
Project Manager	**EA Personnel**
Chief Executive Officer	
Chief Operations Officer	
Application Engineer	
Data architecture	
Infrastructure Architect	
EA academics	
EA practitioners	
EA definitions	**EA Training**
EA literature	
EA historical origins	
EA benefits	**EA Opportunities**
EA challenges	
EA successes	
EA implementation	
EA evaluation	
Scope of EA	
Description of an organisation	
Organisational	**Interoperability**
Semantic	
Technical	
Interoperability framework	
Distributed computing	**Enterprise Integration**
Product data exchange	
Electronic data exchange	
System Connection	
Decision-making	
Organisation barriers	
Alignment	
Business architecture principles	**Business Architecture**
Business process model	
Goals and objectives	
EA policy	
Business process management	
Services delivery mode	
Service support	

EA Codes	Categories
Application architecture principles	**Application Architecture**
Enterprise system	
Logical application	
Enterprise portal	
Telecentres (Self-service)	
Telemedicine	
Data management	
Technical architecture principles	**Technical Architecture**
Shared infrastructure	
Hardware components	
Software	
Security service	
Target architecture	
Community needs	**Information Architecture**
Desires	
Abilities	
Methods	
Organisation systems	
Labelling systems	
Navigation systems	
Information exchange	
Search systems	
Quality	
Availability	

Table 6.10 shows how sub-themes were generated from the sixteen 16 categories. In the process, coded data were revisited in order to identify similarities or overlapping between codes. While themes were generated, relationships between themes were analysed.

The outcome of the search was the discovery of five (5) sub-themes (Table 6.10).

Table 6.10: EA codes (106), categories (16) and sub-themes (5)

EA Codes	Categories	EA Sub-themes
National government	Public Administration	**Administration**
Provincial government		
District municipalities		
Sector level (e.g. health sector)		
Institutional level		

EA Codes	Categories	EA Sub-themes
Rural	Citizens	
Urban		
Semi-urban		
Underserved communities		
Big businesses	Private Sector	
Small business		
Informal business		
Federal enterprises	EA Frameworks	**Architecture Construction**
Government-wide EA		
TOGAF		
Zachman framework		
Gartner		
GERAM		
EA management	Governance	
EA modeling		
EA strategy		
EA integration		
Project and program management		
Assessment and evaluation		
Change process		
Skilled team	Team Capability	
Training and education		
Commitment		
Communication		
Holistic view	EA Planning	**EA Implementation**
Architectural analysis		
Architectural models		
Planning		
Current state		
Future state		
Performance		
Consistency		
Flexibility		
Language		
Managing change		
Top Management		
Organisational culture		
EA Artefacts		
IS planning		
Project Manager	EA Personnel	
Chief Executive Officer		
Chief Operations Officer		
Application Engineer		
Data architecture		

EA Codes	Categories	EA Sub-themes
Infrastructure Architect	EA Personnel (continued)	
EA academics		
EA practitioners		
EA definitions	EA Training	
EA literature		
EA historical origins		
EA benefits	EA opportunities	**EA Strategies**
EA challenges		
EA successes		
EA implementation		
EA evaluation		
Scope of EA		
Description of an organisation		
Organisational	Interoperability	
Semantic		
Technical		
Interoperability framework		
Distributed computing	Enterprise Integration	
Product data exchange		
Electronic data exchange		
System connection		
Decision-making		
Organisation barriers		
Alignment		
Business architecture principles	Business Architecture	**Enterprise Architecture Modeling**
Business process model		
Goals and objectives		
EA policy		
Business process management		
Services delivery mode		
Service support		
Application architecture principles	Application Architecture	
Enterprise system		
Logical application		
Enterprise portal		
Telecentres (Self-service)		
Telemedicine		
Data management		
Technical architecture principles	Technical Architecture	
Shared infrastructure		
Hardware components		
Software		
Security service		
Target architecture		

EA Codes	Categories	EA Sub-themes
Community needs	Information Architecture	
Desires		
Abilities		
Methods		
Organisation systems		
Labelling systems		
Navigation systems		
Information exchange		
Search systems		
Quality		
Availability		

Further searches continued, matching, comparing and reading quotations linked to the codes. The ultimate search delivered two (2) themes (Table 6.11).

Table 6.11: EA codes (106), categories (16), sub-themes (5) and themes (2)

EA Codes	Categories	EA Sub-themes	EA Themes
National government	Public Administration	Administration	**Government EA**
Provincial government			
District municipalities			
Sector level (e.g. health sector)			
Institutional level			
Rural	Citizens		
Urban			
Semi-urban			
Underserved communities			
Big businesses	Private Sector		
Small business			
Informal business			
Federal enterprises	EA Frameworks	Architecture construction	
Government-wide EA			
TOGAF			
Zachman framework			
Gartner			
GERAM			
EA management	Governance		
EA modeling			
EA strategy			
EA integration			
Project and program management			

EA Codes	Categories	EA Sub-themes	EA Themes
Assessment and evaluation			
Change process			
Skilled team	Team Capability		
Training and education			
Commitment			
Communication			
Holistic view	EA Planning	EA Implementation	**EA Construction**
Architectural analysis			
Architectural models			
Planning			
Current State			
Future State			
Performance			
Consistency			
Flexibility			
Language			
Managing change			
Top Management			
Organisational culture			
EA artefacts			
IS planning			
Project Manager	EA Personnel		
Chief Executive Officer			
Chief Operations Officer			
Application Engineer			
Data architecture			
Infrastructure Architect			
EA academics			
EA practitioners			
EA definitions	EA Training		
EA literature			
EA historical origins			
EA benefits	EA opportunities	EA Strategies	
EA challenges			
EA successes			
EA implementation			
EA evaluation			
Scope of EA			
Description of an organisation			
Organisational	Interoperability		
Semantic			
Technical			
Interoperability framework			

EA Codes	Categories	EA Sub-themes	EA Themes
Distributed Computing	Enterprise Integration		
Product data exchange			
Electronic data exchange			
System connection			
Decision-making			
Organisation barriers			
Alignment			
Business architecture principles	Business Architecture	Enterprise Architecture Modeling	
Business process model			
Goals and objectives			
EA policy			
Business process management			
Services delivery mode			
Service support			
Application architecture principles	Application Architecture		
Enterprise system			
Logical application			
Enterprise portal			
Telecentres (Self-service)			
Telemedicine			
Data management			
Technical architecture principles	Technical Architecture		
Shared infrastructure			
Hardware components			
Software			
Security service			
Target architecture			
Community needs	Information Architecture		
Desires			
Abilities			
Methods			
Organisation systems			
Labelling systems			
Navigation systems			
Information exchange			
Search systems			
Quality			
Availability			

Phase 4: Reviewing themes

The themes were reviewed at the two levels of understanding. The first level of understanding is an understanding of the links between codes, categories, themes and sub-themes. The second level understanding involved the reviewing of a theme in context with the whole data set. The outcome of the review stabilised the thematic map, as shown in Figure 6.18.

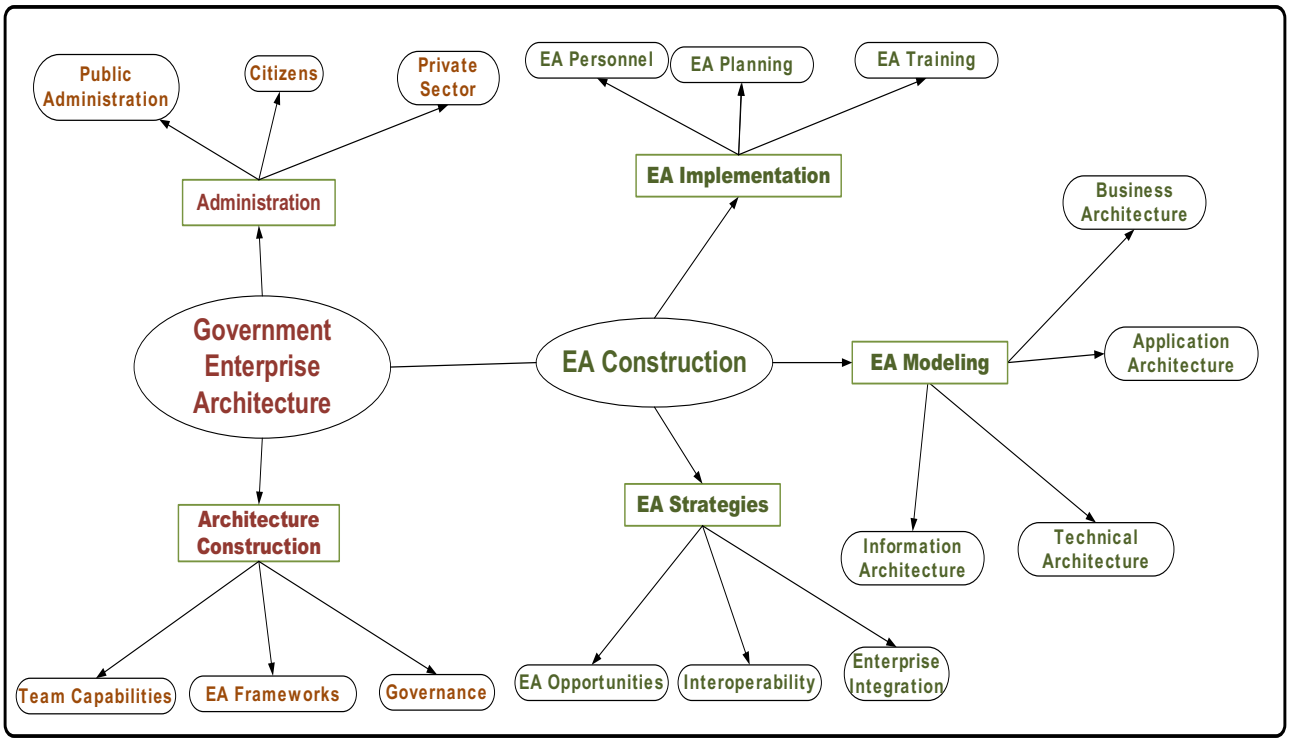

Figure 6.18: Thematic map for government enterprise architecture

Phase 5: Defining and naming themes

In phase 5, the researcher examined the essence of, or the reasons for, the existence of each theme and sub-theme.

Theme 1: Government EA for community development

This theme has two sub-themes, **administration** and **architecture construction**, shown on the thematic map for government's EA in Figure 6.19. The sub-theme *administration* draws on three categories, namely public administration, citizens and the private sector. While the other sub-theme, *administration*, was formulated from three categories, namely team capabilities, EA frameworks and governance. The focus of this theme is on exploring how government's EA can be built in such a way that it defines the critical role required to implement community-based ICT projects in rural and underserved communities. A detailed thematic discussion will be presented in section 6.5.

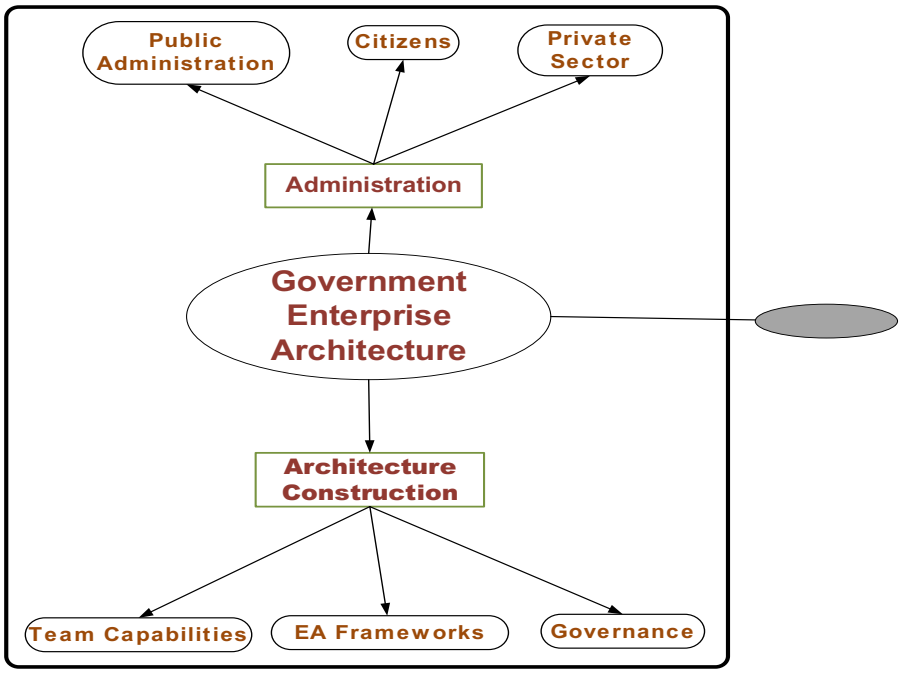

Figure 6.19: Thematic map for government enterprise architecture

Theme 2: EA Construction

This theme was generated from three categories, namely *EA strategies*, *EA modeling* and *EA implementation* (Figure 6.20). EA strategies highlighted EA opportunities, interoperability and enterprise integration, all of which are required to build an EA to serve the communities. A detailed thematic discussion will be presented in section 6.5.

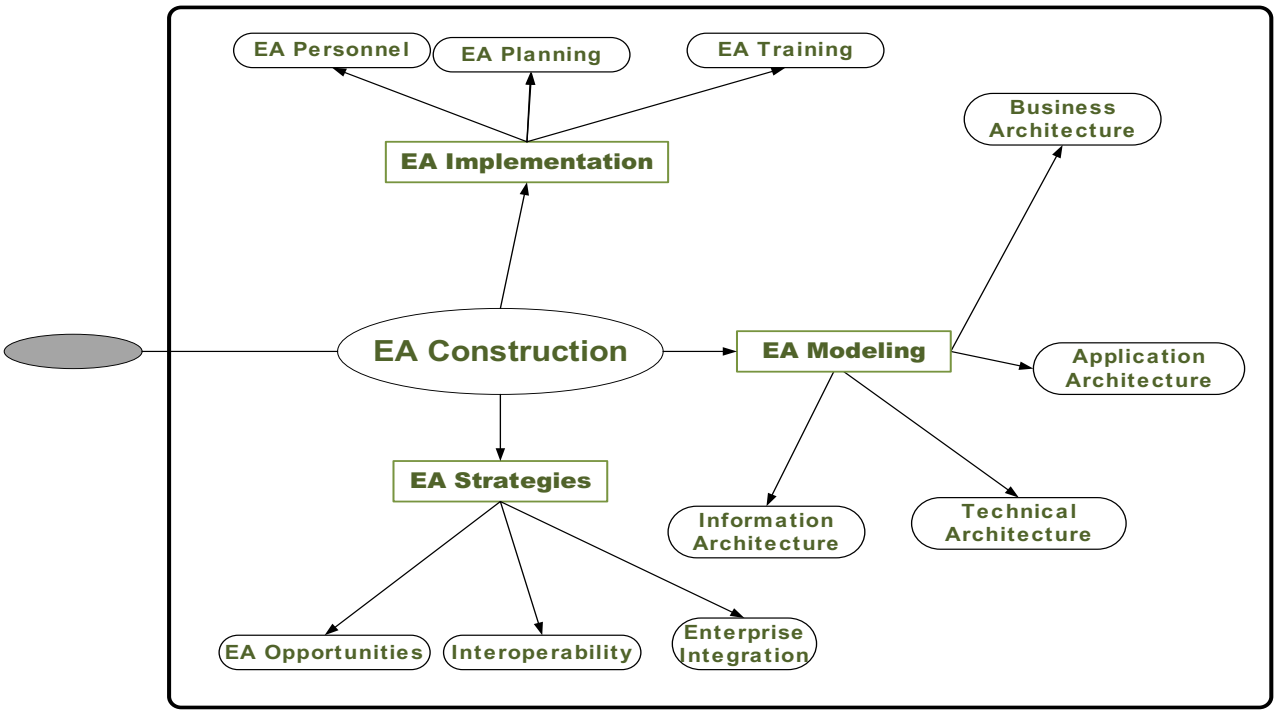

Figure 6.20: Thematic map for enterprise architecture construction

Phase 6: Producing the report

Braun and Clarke (2006:93) argue that the report provides critical evidence of the themes, supported by data. The final comprehensive report is discussed in section 6.5.

6.4 Analysis of DSR sub-cycle 3

In DSR sub-cycle 3 (Figure 6.21), the researcher explored the integrated role played by both the EA and CI disciplines to advance the community. In section 2.5.2, the researcher demonstrated a view that the integration of CI and EA hold the key to human development in rural and underserved communities. EA strategies and standards, mostly tried and tested within business organisations and governments, need to be extended in order to benefit rural and underserved communities. The application of CI in rural and underserved communities needs a boost in order to enable active and participatory citizens.

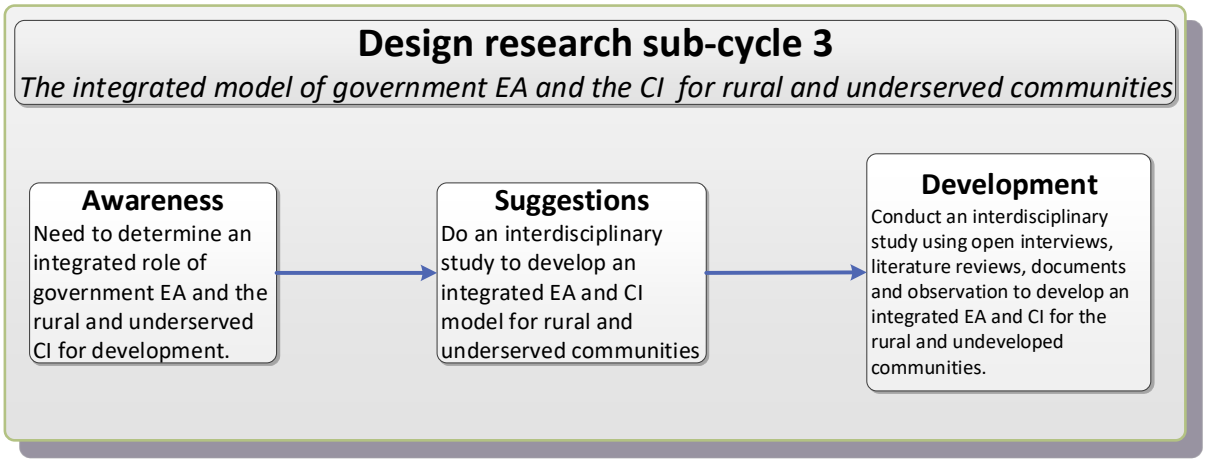

Figure 6.21: Design science research (DSR) sub-cycle 3

SRQ 3 demonstrates the need for an interdisciplinary approach to integrate EA and CI in order to balance the different interests and needs from both the government and the community point of view. Figure 6.22 shows the pointed intersection where the analysis of the integrated role of CI and EA within the community took place.

SRQ 3: How can EA and CI be integrated to address community needs in the rural and underserved communities?

SRQ 3 sought to analyse the CI and EA sub-themes and themes with the researcher interested in finding shared insights between CI and government's EA, which encourages human development and implementation of community-based ICT projects in rural and underserved communities.

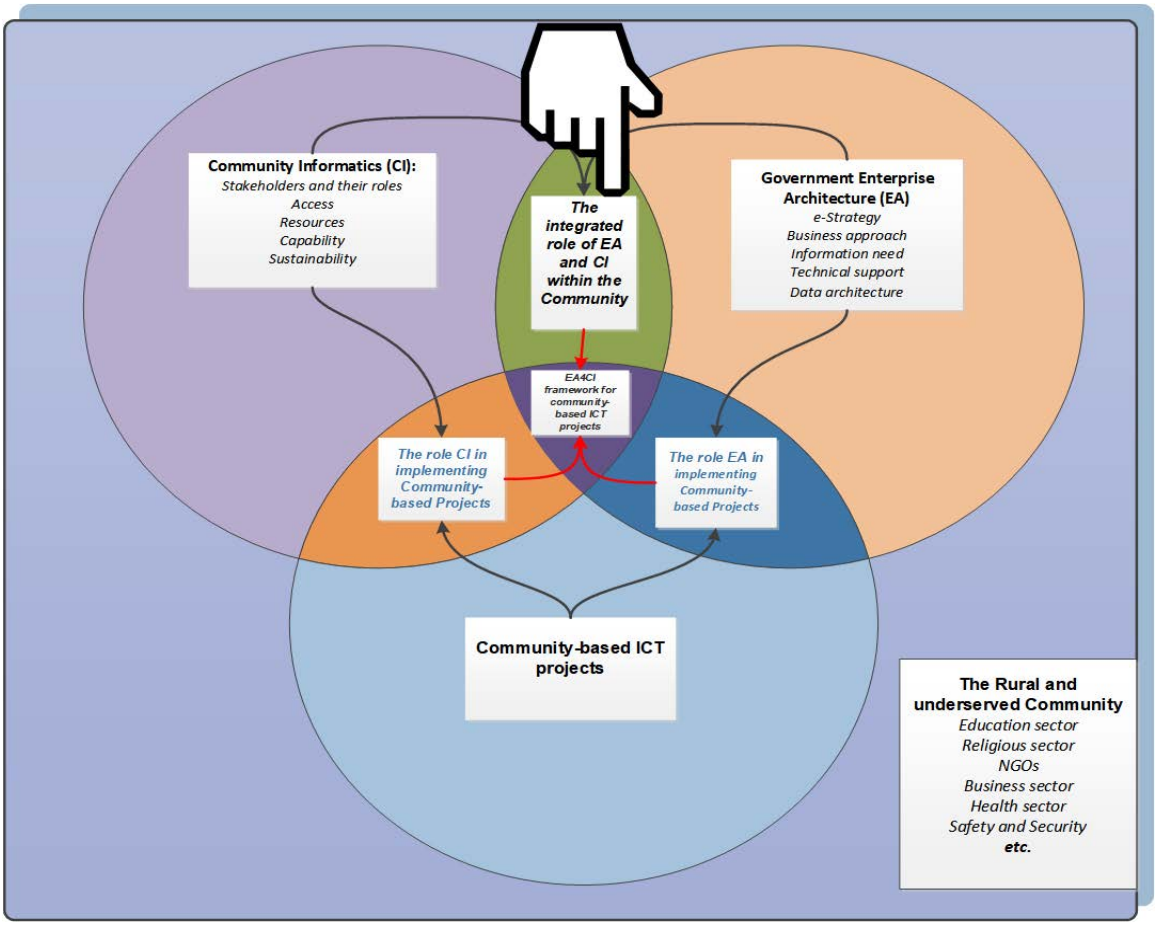

Figure 6.22: Conceptual framework: The integration of EA and CI

6.4.1 The awareness phase

The awareness phase of DSR sub-cycle 3 highlights the need to integrate government EA and CI with the view of providing an effective method for community development in rural and underserved communities. These communities are struggling to get services from the government. On the other hand, the government is struggling to bring services to the communities. The community requires a bottom-up approach, where the community takes control of their situation and communicate their needs to the government. The government, on the other hand, provides the community with the necessary tools required to communicate. SRQ 3's purpose was to investigate synergies that may exist between CI and government's EA for implementing community-based ICT projects.

6.4.2 The suggestion phase

The suggestion phase proposes an interdisciplinary analysis, using the abductive grounded process to integrate EA and CI in order to address the concerns of the awareness phase. The interdisciplinary analysis sought to find common ground between the CI and EA. In this phase, the researcher uses the abductive grounded

theory to abduct a possible integrative solution. The reasons for selecting the abductive grounded theory were discussed in section 5.5.2.

6.4.3 The development phase

The development phase builds on the data collection and microanalysis circle in Rahmani and Leifels's (2018) abductive grounded theory process, complemented by Rambaree's (2018) abductive thematic network analysis (ATNA) using ATLAS.ti, as discussed in section 5.5.2. In this study, Rahmani and Leifels's (2018) emphasis is on explaining the interdependencies between theoretical categories of coded data, while Rambaree's (2018) process explains the linkage between emerging themes and sub-themes.

Rambaree (2018:70) urges researchers to reflect continuously on data and knowledge constructed within the whole research process in order to sensitise researchers of possible biases that may creep into analytical processes when identifying themes. In this section, the quotations, codes and categories of emerged themes and sub-themes captured in ATLAS.ti were revisited and read to understand views of intersections and integration between CI an EA, guided by the SRQ 3. The themes that emerged from sections 6.2 and 6.3 were critical for the integration of EA and CI.

The construction of overlapping themes in this section follows the constructionist approach. The section is, therefore, arranged as follows: Firstly, sub-section 6.4.3.1 deals with theoretical comparisons and matching of the abductive grounded theory; then, sub-section 6.4.3.2 consolidates the themes that emerged from of sections 6.2 and 6.3 so as to identify critical concepts of EA and CI integration.

6.4.3.1 Theory matching process

This section is in line with Rahmani and Leifels's (2018) data collection, microanalysis and three-step theory, matching processing steps (sub-section 5.9.2.3). The results of this process are presented in Appendix H. This section is also in line with the coding process outlined in Step 1 of Rambaree's (2018) process. Appendix H contains a table of the sample of codes that illustrates the coding procedure used to match prospect theory as an influence on the decision to integrate CI and EA disciplines.

Step 1 in Appendix H demonstrates how the results of open coding are associated with potential theoretical areas and key literature. The process in this step inductively identified open (initial) codes from the body of collected data. The defined code promotes the role of criticism in the search for quality responses to the

neglect of rural and underserved communities. Bailey and Ngwenyama (2016:71) argue that the formed concepts envelope the society with an understanding that applied social intervention can close the gap between warring sections of the community. The codes match with Bourdieu's theory of practice (Bourdieu & Nice, 1977) which Walther (2014:8) describes as a social being with diverse motives and intentions to transform the world. In this initial step, there is so much theory that matches open codes, but suffice to mention key literature that cites potential theoretical areas relevant to the study objectives.

In the next critical step (Step 2 in Appendix H), the researcher developed categories and key literature through axial coding (or second-order codes). The emerging categories from open codes included community challenges, government strategy and ICT issues. Bounded rationality, as explained in section 5.6, limits the axial categories to the theoretical area that seeks to deal with the community and e-government theories. The matching theoretical perceptive includes theories such as social sciences incorporating economics and anthropology, systems theory, organisational theory, task-fitting theory, diffusion of innovation, adoption theory, cognitive psychology, management sciences and political science.

The matching theories mentioned thus far abduct (or leads away) by ensuring the participation of rural and underserved communities in PDT, as explained in section 3.6.

Rahmani and Leifels's (2018) three-step process (open, axial and selective coding) is not linear but involves reflective and analytical thinking about existing theories and models, such that the PDT suitably matches the integration of EA and CI. The process of theory matching and, following the emergence of the construct, the participatory theory is persuasive as a basis for explaining the integration of EA and CI. Framework design assists in learning and understanding behavioural attitudes related to IS and its use (Alobaydi et al., 2018). This claim agrees with the evolution of (PDT) that is used as a theoretical lens through which to develop the EA4CD framework. The claim paves the way for an investigation of the integration of EA and CI.

6.4.3.2 Developing an EA and CI model

In this sub-section, the researcher developed an EA-CI model by creating and describing linkages between themes using abductive reasoning through inferences, with iterative movement between data or evidence and themes (Clarke & Braun, 2013; Rambaree, 2018), while also laying claim to the matched theory in the

previous sub-section. Rambaree (2018:72) defines a linkage as an interpretive flow describing the observed phenomena with the observed data or evidence.

The development proceeded as follows: sub-section i) below focuses on the creation and development of thematic linkages that explain the observed patterns as guided by SRQ 3. This process followed step 3 of Rambaree's (2018) process, as explained in section 5.9.2. Sub-section ii) explains the observed EA-CI pattern and development of a plausible EA-CI model. The process followed step 4 of Rambaree's (2018) process, which was explained in section 5.9.2. Finally, in sub-section iii), the developed EA-CI model is assessed.

i) Creating and developing linkages between themes using thematic networks

The emerging themes in both CI and EA were presented in sections 6.2 and 6.3, respectively. CI presented eight themes (two themes from ICT individual interviews and six themes from a focus group on CI), while EA presented two themes. All ten of the themes were coherently linked to quotations from the data or from transcribed scripts. Table 6.12 provides a summary of the themes discussed. Table 6.13 demonstrates the creation of thematic linkages as guided by SRQ 3.

Table 6.12: Summary of CI and EA sub-themes

Theme Code	Sub-theme Code	Themes description
CIT1		**The need for a stable infrastructure and technology**
	CIST1.1	The community ICT technical support
	CIST1.2	The community ICT operations
	CIST1.3	Access needs
CIT2		**The need for ICT education and ICT skills training**
	CIST2.1	The community ICT needs
	CIST2.2	The current ICT status
CIT3		**The community background**
	CIST3.1	Employment status
	CIST3.2	Education background
	CIST3.2	Community leadership
CIT4		**The need for rural community leadership**
	CIST4.1	Skills audit
	CIST4.2	Political leadership
	CIST4.3	Private sector
	CIST4.4	The government
CIT5		**The rural community needs**
	CIST5.1	Human basic needs
	CIST5.2	Need for dedicated leaders

Theme Code	Sub-theme Code	Themes description
	CIST5.3	Need for economic development
	CIST5.4	Social inclusion
	CIST5.5	Changing demographics
CIT6		**Ownership**
	CIST6.1	Sense of ownership
	CIST6.2	Responsibility
	CIST6.3	Stewardship
CIT7		**Motivation**
	CIST7.1	Community goals
	CIST7.2	Community advancement
	CIST7.3	Ownership
CIT8		**Community sustainable relationships**
	CIST8.1	Sustainable development
	CIST8.2	Community stakeholders
EAT9		**Government Enterprise Architecture**
	EAST9.1	Administration
	EAST9.2	Architectural construction
EAST10		**EA Construction**
	EAST10.1	EA Strategies
	EAST10.2	EA Modeling

Legends: CIT*n* = Community Informatics Themes; CIST*n* = Community Informatics Sub-themes

Eleven linkages were identified as $_1$… $_{11}$. The list was not exhaustive. Suffice to state that the results of the linkages satisfied the quest to respond to SRQ 2. The search was not a linear process but a cyclic and reflexive process. The outcome of the process defined the integration of CI and EA (Table 6.14).

$_1$… $_{11}$ represent the integration of CI and the government's EA, based on the themes that emerged in the previous sections.

$_1$**: The need for qualified ICT/EA experts:** Participants in rural and underserved communities requested that the government appoint capable, skilled and committed ICT teams that understand the issues affecting rural communities. P13 said that, "the ICT expertise and strengths within the government should be passed on to the communities. They need to communicate better. Tell us what is possible or not. They should not just implement what they feel like implementing" (Appendix M).

$_2$**: The need for a stable ICT infrastructure:** The purpose of the ICT infrastructure development is to provide a platform from which all ICT programmes will run. Poor ICT infrastructure negates the idea of community development, as the infrastructure may not support the implementation of community-based ICT projects.

P20 asked the following: “What is the point of having Smartphones and not be able to operate them? Poor infrastructure demotivates” (Appendix M).

Table 6.13: EA and CI thematic linkages table

			EA Themes				
		EAT9			EAT10		
			EAST9.1	***EAST9.2***		***EAST10.1***	***EAST10.2***
CIT1		2					
	CIST1.1						
	CIST1.3						
CIT2			6				11
	CIST2.1						
	CIST2.2						
CIT3							
	CIST3.1						
	CIST3.2						
	CIST3.2		3				
CIT4					4		
	CIST4.1						
	CIT4.2					9	
	CIST4.3						
	CIST4.4		1				
CIT5							
	CI ST5.1						
	CIST5.2						
	CIST5.3						10
	CIST5.4						
CIT6		7					
	CIST6.1						
	CIST6.2						
	CIST6.3						
CIT7							
	CIST7.1						
	CIST7.2						
	CIST7.3						
CIT8							
	CIST8.1						
	CIST8.2			5			

CI Themes

Legends: CIT*n* = Community Informatics Themes; EAT*n* = Enterprise Architecture Themes.
CIST*n.m* = Community Informatics Sub-Themes; EAST*n.m* = Enterprise Architecture Sub-Themes

$_3$**: The need for visionary community leaders:** Good community leaders mapped to excellent top ICT managers in the government will provide the rural communities with visionary ICT programs. P19 said that, “government should

remember that the government is of the people, by the people and with the people" (Appendix M).

$_4$**: A community-based configured government EA:** The rural and underserved communities are well placed to define the EA models and artefacts that best suit the environmental conditions. Community stakeholders are well placed to explain the current status and future situation. They know people and understand people's customs and traditions. P2 said that the "rural people are often undermined because of the level of education. They misinterpret the quietness of the community to lack of knowledge" (Appendix M).

$_5$**: Unity of action among the community leaders and stakeholders**: The community leaders and stakeholders can contribute to the building of a suitable EA scope. P23 said that, "EA can be so large, confusing and unmanageable whereas an EA designed according to the rural committee's mandate can serve the community better" (Appendix M).

$_6$**: The role of EA management:** The role of the top EA managers within the government is critically important to motivate and encourage communities to improve their IT skills. P15 indicated that, "we get motivated when we see what we can achieve with IT devices" (Appendix M).

$_7$**: The need to cultivate a sense of community ownership:** A sense of ownership is a contentious issue in South Africa, be it land or housing. P11 mentioned that "the sporadic violent service protests which often take place in our communities are as the results of lack of understanding of ownership. Communities don't own anything, and hence it is so easy to burn and destroy" (Appendix M). The government and the community should hand over some of their ICT programmes.

$_8$**: Community independence:** Community independence and self-sufficiency enhances communities' confidence in their quest for knowledge. The process of acquiring information is essential to community development. P4 said:

> "Our community need to embrace the sense of seeking knowledge because knowledge empowers and enables the community to become more independent... Community independence encourages the community to protect what they have instead of burning it, as we have seen with service protest deliveries. Schools, library, clinics are burnt down and destroyed because communities lack a sense of ownership. Government leaders should work with the communities to instil this sense of ownership" (Appendix M).

Several other participants agreed with this view (P4, P5 & P6) (Appendix M).

$_{9}$**: Rural and underserved community environment**: Politics in South Africa requires a stable environment in order to rebuild the communities ravaged by inequalities. P15 remarked the following:

> "Politics in SA should destabilise community development. At the moment, party politics are causing more harm than not good. There are more politics than actual re-building and development. There are fights in municipalities, local government and national parliaments. The environment is tense and toxic, filled with fights, destruction and burning of infrastructure. How we wish our communities can change this environment to attract more investments for our communities" (Appendix M).

$_{10}$**: The work and relationship culture:** Government culture and community relationships are critical to community development. An open and expressive government culture is an enormous bonus for the communities. Conversely, a passionate community makes it easy for the government to encourage community development.

$_{11}$**:** The community expressed the critical need for better education, community skills training and access to information by the community. P9 said that they "wish to open] a skill training college in our community where our youth can learn skills while they are looking for jobs" (Appendix M).

ii) Developing a plausible EA-CI model

The outcome of the theory matching process in 6.4.1 is the notion that participation is a necessary component of effective implementation of community-based ICT projects. This outcome supports the development of a plausible model. A plausible model was developed as a result of linkages between the conceptual framework and the thematic map of 6.4.1.

Haig (2018b) argues that analogical reasoning is essential to creating a plausible model abductively. Analogical reasoning is suitable for theorising about what is known from literature reviews and conceptual frameworks, for example, to the less known or better-known situation. The 'known' now is the conceptualisation of the problem as presented in Chapter Three (Figure 3.4), which builds the model on four premises: (1) participants; (2) capabilities; (3) stakeholders; and (4) sustainability. The 'unknown' is the plausible model that integrates EA and CI. In Figure 6.23, the researcher argued that the integration of EA and CI could be better known under the auspices of the four premises of participation discussed in section 3.5. The plausible

model holds the integration together in order to implement better community-based ICT projects that embrace the community.

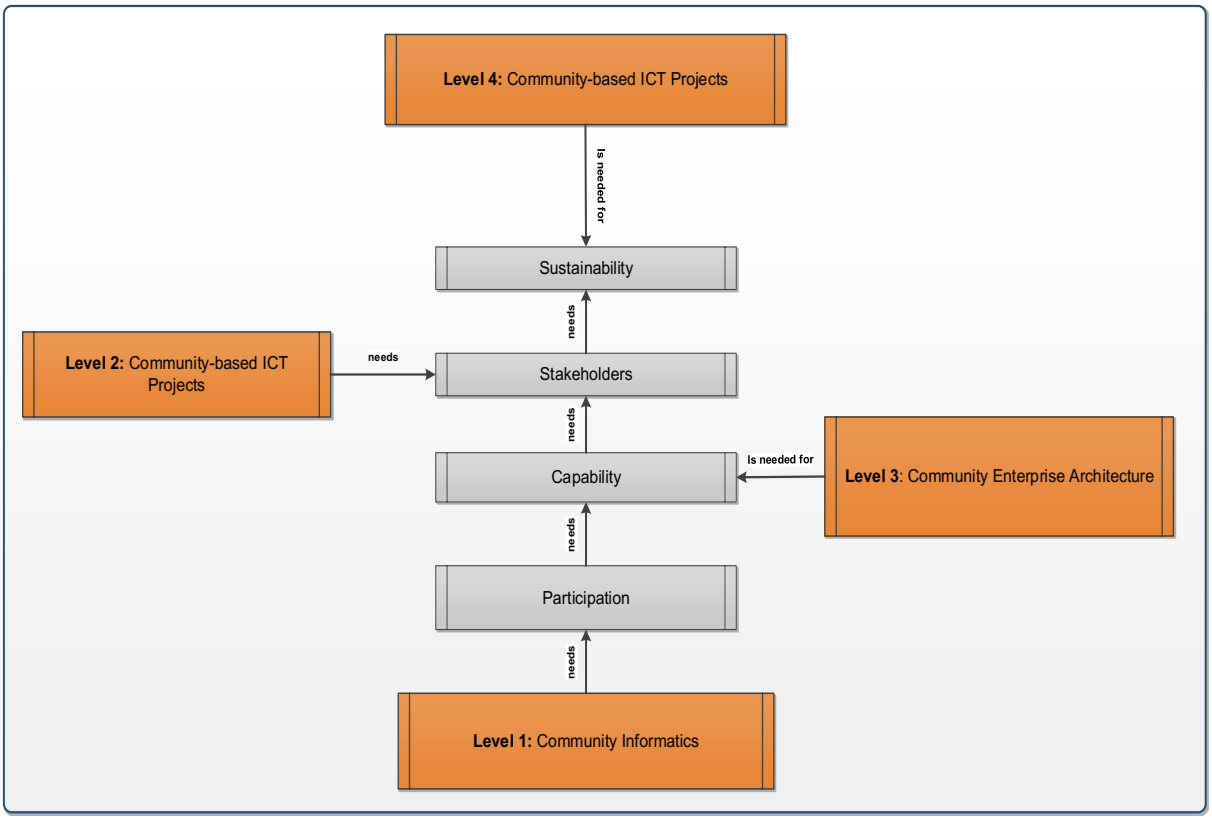

Figure 6.23: Developed EA-CI integration model
(Mapped on the conceptualisation of the problem Figure 3.4)

iii) Assessing the developed model

The next step assesses the plausible model for 'explanatory goodness' in comparison to existing model(s) or explanation(s) from literature Rambaree (2018:80). The model was assessed for its theoretical elegance, coherency and scientific standing (Haig, 2018a). Haig suggests two techniques of "inference to the best explanation" and "theory explanation coherence" to assist in assessing the model (Haig, 2018a:52). Haig (2018a) further suggests three criteria for evaluating coherency in the theory explanation coherence as follows (Ibid.):

i) **Consilience (explanatory breadth):** This criterion captures the idea that explanation breadth provides an excellent range of facts. For example, as depicted in Figure 6.23, the EA-CI model went through the available theoretical knowledge on EA and CI, gained through a review of literature (Chapter Two). EA practitioners could not explain the integration of the two disciplines. EA practitioners view EA as a model fit for large businesses but one that cannot be applied in a rural and underserved settings. The developed EA-CI model includes sustainability, participation, stakeholders

and capabilities, and draws in a component of CI into EA, useful in rural and underserved communities.

ii) **Simplicity:** This criterion makes simple assumptions that do not sacrifice adjustments made to the theory in order to accommodate the model. An assumption is advanced that EA is stable and cannot be applied to a rural setting. The empirical data demonstrates that the criteria required within large business companies and government departments are the same criteria required in CI to operate in rural areas. Simplicity is guaranteed, and there are no new theories necessary to advance the integration of EA and CI.

iii) **Analogy:** This criterion supports analogy to theories that scientists already find credible. Haig (2013:1) argues that an analogy is the "known nature and behaviour of the source that builds an analogical model of the unknown subject or causal mechanism". Both the EA and the CI disciplines are known to researchers, and they encapsulate developed theories. The integration model builds on credible strategies that both these disciplines have.

The results obtained from this EA-CI model are essential to the design-build-test DSR cycle. The theory matching process and development of the EA-CI model provides a base on which to develop the EA4CD framework. Both Rahmani and Leifels's (2018) and Rambaree's (2018) processes assist in inferring the best explanation for creating a plausible model that is necessary.

6.5 Thematic discussion

In the preceding sections, thematic analysis phased process ensued from the collected data from the rural and underserved community, Western Cape Government officials and academia. The analysis resulted in ten major themes (sections 6.2, 6.3 & 6.4).

Each of three sub-sections (6.5.1, 6.5.2 & 6.5.3) provides further discussion on ten themes and then provides responses to the sub-research questions (SRQ 1, SRQ 2 & SRQ 3). Section 1.4 began the process by stating the research problem, followed by the primary research question and the three sub-research questions. Since the research process was influenced by DSR, three DSR sub-cycles and the main DSR cycle, ten themes provided possible findings with respect to the class of problems.

The researcher restates the research questions in Table 6.15, as a summary of findings of the ten themes need to be provided. The next sub-sections (6.5.1, 6.5.2 & 6.5.3) deal with the narrative account of the ten themes related to DSR sub-cycle

1, DSR sub-cycle 2 and DSR sub-cycle 3, providing data excerpts and adding meaning of the themes. Sub-section 6.5.4 provides a summary of the findings.

Table 6.14: Research questions

Primary research question (PRQ)	**Objectives**	**Research method**
How can an Enterprise Architecture for Community Development (EA4CD) framework be developed to integrate EA, CI, and community needs to assist with the implementation of community-based ICT projects in rural and underserved communities?	To propose an EA4CD framework that can guide the development, deployment and implementation of the community-based ICT projects with a view of improving the living standards within the rural and underserved communities	Interviews
Sub-research questions (SRQ)	**Objectives**	**Research method**
SRQ 1: Why are rural and underserved communities not benefiting from CI when implementing community-based ICT projects?	To examine the reasons why rural and underserved communities are not benefiting from CI when implementing community-based ICT projects	Interviews Focus group Documentation
SRQ 2: What is the role of government EA in implementing community-based ICT projects?	To determine the government's role of EA in implementing the community-based ICT projects in rural and underserved communities	Interviews Documentation
SRQ 3: How can EA and CI be integrated to address community needs in the rural and underserved communities?	To integrate the roles of EA and CI, considering the community needs with the view of implementing community-based ICT projects	Analysis Documentation Observations

6.5.1 DSR sub-cycle 1 theme discussion

6.5.1.1 Theme 1: The need for a stable infrastructure and technology

Participants viewed the stable ICT infrastructure and technology as a backbone critical to community development. The community participants were clear and consistent about the need for stable ICT infrastructure and technology. Community-based ICT projects cannot be successfully deployed and implemented on the back of an ICT infrastructure that lacks stability. The participants' responses reflected that the rural and underserved community has more to gain if the ICT infrastructure and technology is stable. P11 said that, "I have observed over the time I have worked at Thusong e-Centre that ICT infrastructure remains the number one problem that slows down the use of IT within the community and by so doing, discourages the community in using available ICT solutions… ICT solution motivates the community"

(Appendix M). P4 responded by saying that “working ICT solutions motivates and makes our jobs easier but the systems that keeps on failing demotivates and takes us back to the stone age…” (Appendix M).

The results of reflexive TA demonstrate that having stable ICT infrastructure and technology is based on the needs for community ICT technical support, community ICT operations and seamless access to technology (sub-themes).

Sub-theme 1.1: The community ICT technical support

The participants viewed the use of ICT as an opportunity to provide technical support for manual activities that are sometimes laborious and difficult to carry out because of limited resources. P3 explained the role of ICT technical support as follows:

> “The role of ICT within the community is critical. I can’t imagine life without ICT. For example, if there was no ICTs, there will be no way of communication, no information and no life. It would have been difficult to get adverts for employment... Without ICTs, our youth will be completely lost... No one will know about this community and the experienced daily struggles for survival” (Appendix M).

P12 added by saying that “ICT connects us with people locally and internationally. We are able to chat, and at times speaking through with them on a video connection” (Appendix M). P15 said that, “We are able to buy goods using the online shops” (Appendix M). P4 stated the following: “We are able to get online services from the local government. It makes life easier; instead of going to town, we can access some services through the use of ICT” (Appendix M). These participants demonstrated the strategic technical role that ICTs could play in sustaining the rural and underserved community.

Sub-theme 1.2: The community ICT operations

Participants demonstrated the current ICT applications that are popular to the community. P6 complained about the poor connectivity, expensive devices and the high cost of data: “Internet in our area is not so good. In some cases, we have to look for a stronger signal in our area. Also because of the cost of software programs such as Microsoft programs, we struggle to do work” (Appendix M). P12 explained how they connect:

> “The high school in our area has Wi-Fi. When we are close to the school, and knowing the password, which learners of the school share with us, can get access to the school’s Wi-Fi facilities without getting into the premises. And, Thusong e-Centre is in town, some distance away from our place has

> free Internet. Free Wi-Fi is also available from KFC outlet in town, which is far from us. Besides, if we have money, we will buy data from one of the Vodacom, MTN or Cell-C outlets. Sometimes, purchasing data does not mean that access to the Internet is readily available" (Appendix M).

The majority of crèches and children's after-care centres do not use any ICT. There is one aftercare centre in this community, which is fully equipped with tablets, donated by an overseas donor. The manager of this facility is inundated with requests from children who seek admission and exposure to the centre. The remaining five aftercare centres within the community are without ICT. They expressed the desire to have ICT available to allow the children to acquire essential ICT skills at an early age. P8 said:

> "I don't see us having computers in our centre shortly. We are still struggling to fix this structure [a shack] to make it suitable for the little ones and acquire learning aids. Look at the condition of this crèche. They are not conducive to learning. However, we exist to help the poor parents who have no one to look after the kids while they are at work" (Appendix M).

The community needs a strong presence of working ICT applications in order to use ICT. The belief is that if ICT applications are working adequately, communities could participate in community development.

Sub-theme 1.3: Access needs

Participants indicated how access could improve the living conditions of rural and underserved communities. P4 sadly expressed the need for access:

> "Lack of access to ICT limits progress and modernity. We feel less important, lacking self-worth and dignity. We can see other communities are more enlightened than us who grope in darkness… The lack of access to information is like a death sentence for this community. The sad reality is that government emphasis is on access to ICT and the fourth industrial revolution and yet we struggle to get basic access to ICT. Besides expensive computer devices, data and airtime, the basic ICT we have in community is unreliable" (Appendix M).

P9, P10 and P14 explained ICT benefits and some challenges associated with ICT. Schools, churches and the local municipality could assist the community with access the internet, Wi-Fi and ICT programs. Ps expressed the notion that the digital divide was no longer about the knowledge of IT but access to IT. It is about the resources.

6.5.1.2 Theme 2: The need for ICT education and ICT skills training

Participants in this theme indicated the need for ICT education and the ICT skills training and exposure as way to re-skill the community. P5 said the following:

> "…there are scores and scores of people in our communities who are unemployed and the majority of them are young people. Advertised jobs on the market require employee to possess some knowledge on the computer usage and some end-user computing skills. The community e-Centre is good start but not adequate to uplift the community and improve the communities' end-user computing" (Appendix M).

P12 said that their "rural communities must have an ICT training centre" (Appendix M).

The training will give community members the confidence to communicate and articulate their views.

Sub-theme 2.1: The community ICT needs

The participants had strong views about community needs that could be addressed using ICTs. P3 felt that the unemployment rate could be reduced if the community needs were addressed using ICT solutions. For example, ICT could be used to address crime, substance abuse and unemployment among the youth. P13 said that the "community database could profile everyone living in that community and members of the community could update it as and when the need arises" (Appendix M).

Community communication can be stronger if ICT intervention are implemented and if it has an ability to reach everyone within community.

Sub-theme 2.2: The current ICT status

The status of ICT usage within the community indicates that not many ICT programs are used by the community. P6 argued that most of the people "I know use WhatsApp, Facebook, SMS and Skype to communicate with friends and relatives. This is an efficient way of communicating with those we know and love…. There are no apps developed specially for the community" (Appendix M). P7 argued that more could be done: "Universities use online registrations, and our school can benefit more, churches can benefit more, and crèches can benefit more" (Appendix M).

Better usage of the current ICT facilities could inform future community ICT qualities. The current views of the community could inform future ICT infrastructure quality.

6.5.1.3 Theme 3: The community background

This theme revealed the current composition of the community. The focus group participants (FGPs) revealed the kind of jobs and the education status of the community. FGP24 said that there are learners "dropping out of school…if you, walk the streets on mid-morning, mid-week, you will see many ex-learners rooming the streets…Jobs are scarce". FGP25 said that as a pastor of a church, he sees "many crèches in informal settlements. There are many volunteers looking after young children whose are looking for a job, just to buy food for the day" (Appendix N).

Sub-theme 3.1: Employment status

The sub-theme revealed the current employment status within the community. FGP26 stated the dire situation of employment in the community. FGP28 said that, "employment is most available in the farming sector, especially during reaping… People from as far as Malawi, Zambia, and Zimbabwe and local South African compete for a few seasonal jobs… The state of employment is not good at all…" (Appendix N). FGP30 added to the by saying that "a number of NGOs, after-care centres and the municipality in Grabouw are providing jobs for the community. But, a large number of people, mainly youth, are sprawling the streets of this community looking for jobs" (Appendix N).

The overall picture is that the employment status of this community is dire.

Sub-theme 3.2: Education background

Firstly, the educational background of the community as a category featured as a critical category, as it demonstrated the possibility of community participation in the development of ICT within the community. It emerged that the community's educational background centred mainly on professions such as educators, including early childhood teachers, child minders, nurses and police. FGP24 argued that:

> "The community need[s] a TVET college or universities in Cape Town should open branches within this community so more professions are taught to our children. If CPUT can open a campus here in Grabouw, we can spend less on education as children will be staying at home, while they study… And, in addition, they will be exposed to a number of professions" (Appendix N).

FGP28 added the following: "Most people now are working as farm workers in the surrounding farms. TVET (Technical and Vocational Education and Training) colleges can assist in up skilling these people so they can start their own companies" (Appendix N).

It is critical that skills training and education for the rural and underserved communities be encouraged.

Sub-theme 3.3: Community leadership

This sub-theme explains that the community background is one of community leadership. The question was asked whether the community has leaders or people of influence who could be the voice of the community. FGP33 replied that the community does have "leaders in various sectors of the community. Known church leaders, politicians, influential educators, NGO managers possess an ability to move this community forward…" (Appendix N). FGP33 reminded everyone of successful political and service delivery protests, and the way politicians led these demonstrations against the government. The same energy could be used to develop the community.

6.5.1.4 Theme 4: The need for rural community leadership

Although this theme has much in common with the previous theme, it was crucial to state the need that emerged here was for steadfast community leadership. FG27 argued that the "community leaders are critical to the development of communities". FG28 added that, "projects are bound to fail if community leaders are not involved.

Sub-theme 4.1: Skills audit

The FGPs revealed that a skills audit within the community could contribute to the development of the community. FGP30 agreed that the community "can work with what they have and improve ICT skills to make people better in what they do". FGP32 said that in their community, "there are several skills. These skills are truck, taxi drivers, farm workers, hairdressers, carpentry, and aftercare. These skills are popular in this community". FG29 added that ICT should "…permeate jobs and …talk to these available skills". CI should embrace the development of these skills. FGP30 argued that, "CI development, and in particular ICT should address the current and the present situation and then once it is established, it can be built into a larger force that can build other skills".

Sub-theme 4.2: Political leadership

The FGPs demonstrated that politics in this community play a critical role. FGP31 argued as follows: "Political leaders should listen to the mandate of the community" (Appendix N). FG29 said that, "politics are hindering progress at this community. Service delivery protests are violent, led by the politicians, who reverses good gains through damaging of roads, schools and all other public institutions" (Appendix N).

This sub-theme demonstrates the critical position politicians could occupy to assist the community in developing themselves.

Sub-theme 4.3: Private sectors

The next sub-theme defined the role of the private sector in developing the community. FGP26 argued:

> "The private sector establish[es] proper links with [the] community to assist the communities in their development. The private sector should be seen to assist, instead of colonising. It is important to tap on the local resources as far as it is possible. Some companies have what is known as [a] community responsibility program, which are at times less coordinated and unstructured. If the synergies between the private sector and the community can be explored in such a way to benefit both, then communities can improve" (Appendix N).

FGP25 agreed that some companies act as gatekeepers to ensure that a certain agenda succeeds. An example of this could be an external religious-based organisation donating laptops to an aftercare NGO with the purpose of disseminating their religious views in the community. FGP27 added that, "donors would go to an extent of giving incentives to only those who affiliate to this particular religion" (Appendix N). FGP33 argued that private organisations are in an advantageous position to encourage social programmes that could lead to social cohesion.

Sub-theme 4.4: The government

The FGPs explained the role of the government and proper governance that they could have for the community. FGP30 said that the government "take[s] decisions to allocate resources and to initiate community projects because the people in government are from communities and so they can help people in rural communities" (Appendix N). FGP24 stated that, "people in government should be educated enough to know to interpret legislation directed to assist the rural communities".

Without the government understanding how the decisions are taken, rural communities will continue to struggle.

6.5.1.5 Theme 5: The rural community needs

FGPs agreed that ICT projects could provide answers to the community needs. FGP26 said that a "large number of youth is unemployed. Thusong e-Centre provides assistance to the youth to find jobs by searching the internet. The centre

provides facilities for the unemployed to create CVs and send e-mails". FGP33 identified an opportunity to boost the safety and security for the community, especially the children and women, using ICTs.

The community has a number of needs that hinder progress, most or all of which could be addressed using ICT.

Sub-theme 5.1: Human basic needs

The FGPs recognised that for community development to succeed, human basic needs should not be ignored. FGP33 stated that their community "is trapped in a cycle of violence, crime, drugs because of poverty, unemployment and inequality…. Life is hard for some families. Young people resort into substance abuse and crime as a way of crying out for help". FGP33 raised the issue of basic service delivery protests that are a frequent occurrence in this community. She said that the "protest in our community demonstrates the lack of trust to the authorities to provide jobs that address the basic human needs" (Appendix N).

Sub-theme 5.2: Need for dedicated leaders

The need for dedicated leaders, driven by the passion for emancipating the community, is at the heart of the community's vision for change. FGP31 said that, "serving and elected councillors have a duty to fulfil. The duty is that of serving the people with honour and dignity. We, councillors, tend to forget that calling and fund ourselves in petty politics and self-serving activities… Councillors are call[ed] to serve". FGP 25 agreed and said that this country needs "dedicated leaders; leaders who take their responsibility seriously. If our leaders can take serious servant hood, this community can be self-sufficient and independent". The FG participants highlighted corruption as the "cancer that eats away this society" (FGP25) (Appendix N).

Sub-theme 5.3: Need for economic development

Economic development is a priority for this community because it could enable the community to be independent and for members to sustain their households, thus, reduce crime generated by poverty. The economy is a global act that requires its actors to compete on a global stage. FGP28 stated that, "big business in our community is already a player in the global stage. The companies in our town export fruit and fruit product to the global markets. This is commendable. However, the community has not benefited" (Appendix N). The community needs to set up a strategy that would benefit even the small business in the rural and underserved areas" (Appendix N).

Sub-theme 5.4: Social inclusion

The third category deals with the need for social inclusion. FGP21 argued that, "social cohesion in rural development simplifies issues of trust, and working together as members of the same community" (Appendix N).

Sub-theme 5.5: Changing demographics

Changing demographics affect the ability to address rural community needs. FGP24 argued that people "living in rural communities are mobile, which make it difficult to cater to the needs of the community. Some rural community members are leaving rural areas to live in urban cities, and thus causing a strain of strain in service" (Appendix N).

6.5.1.6 Theme 6: Ownership

Ownership is a contentious issue in South Africa, be it land or housing. FGP30 indicated that the "sporadic violent service protests which often take place in our communities are as the results of lack of understanding of ownership. Communities don't own anything, and hence it is so easy to burn and destroy" (Appendix N). The government and the community should work together to plan, design and deploy CT programmes. FGP32 stated that in most instances, "government plan[s] for the community, but not with the community. Our councillor has no clue about what we need and when we need. Most of our people stay in shacks; they have no home they can proudly point as theirs. The environment in which people live in is unacceptable. The community cannot be proud and say we own A, B, and C" (Appendix N). As a result, FGP30 argued that most of the times, "communities destroy the infrastructure because they don't have the sense of responsibility to say these roads, buildings are ours. We have to look after them" (Appendix N).

Sub-theme 6.1: Sense of ownership

The FGPs noted that the sense of ownership comes with the idea of a claim that the community owns assets even though the government gave these assets. FGP29 said the following: "Feeling the ownership means that I have an environment to look after. It means taking care of community buildings and infrastructure, taking care of the surroundings and keeping them clean".

A sense of ownership is a special type of a feeling that protects rather than abuses any asset.

Sub-theme 6.2: Responsibility

Responsibility is defined as an attribute, meaning the entire community should know there are consequences for any action. Therefore, a decision taken by individuals and a collective decision are followed by the actions, albeit good or bad. FGP25 stressed the importance that “the community knows that for action, there will be a reaction. Community development seems not to be progressing as it should. The problem is that what we have, we destroy it. How can we attract investments to our communities if we do not act responsibly?”

The FGPs agreed that there should be a change within the community – a change that would reflect progress. ICT programme change is a catalyst for this change.

Sub-theme 6.3: Stewardship

Stewardship was raised as an essential factor in developing the community. FGP24 said that they “must canvass our community into a sense of being good stewards. It is important to manage meagre resources we have so that we can manage the larger resources” (Appendix N).

The management and wise use of resources is characterised as critical in promoting good governance and good followers.

6.5.1.7 Theme 7: Motivation

The FGPs opined that the need for motivation is a critical theme to ensure that communities develop. The FGPs stressed that intrinsic motivation is a virtue to possess and to pass on to the community.

Sub-theme 7.1: Community goals

FGPs argued that communities do have goals. FGP33 stated the following: “As communities, we aspire to live a better life. We want to see our children in better jobs, living comfortable with their families” (Appendix N). FGP31 said that the “number one priority in this community is land to build a home, and the service delivery to improve the communities’ lives. Communities needed to align their needs to inspire the whole community to work towards a particular goal” (Appendix N).

Community goals determine what ICT products, approaches and training are required by the community.

Sub-theme 7.2: Community advancement

The FGPs agreed that rural and underserved communities require better living conditions than people living in urban areas. FGP28 stated that, “rural communities must be willing to cultivate a culture of work. ICT sometimes brings a sense of

instant results and people to forget that they still need to work hard to advance or bring a better life to all its citizens".

Sub-theme 7.3: Community expectations

FGP27 argued that, "fulfilled and reasonable community expectations motivate the community to do better". FGPs agreed that community leaders should manage community expectations so that the realisation of those expectations would motivate the community to achieve more reasonable gains.

6.5.1.8 Theme 8: Community sustainable relationships

FGPs argued that for any successful venture, sustainability becomes critical. Figure 6.17 demonstrates that sustainable development and community stakeholders are key to improving the lives of community members. The community argued that for example, "in ICT, dropped calls, intermittent internet supply does not contribute to the sustainable use of ICT within the communities" (Appendix N).

Sub-theme 8.1: Sustainable development

FGPs agreed that for projects to last, the community must understand the value and worth of projects. FGP30 said that, "if communities do not embrace the project, it is bound to fail. It is, therefore, critical for the government to plan with the community, but for the community, because together, we initiate sustainable projects".

Sub-theme 8.2: Community stakeholders

The FGPs identified a list of people that they think would be fit to be called community stakeholders. The list is shown in Table 6.15.

Table 6.15: Community stakeholders linked to community needs as observed by the focus group

Community Stakeholders	Community Needs
Municipality Officials	• Slow pace service delivery • Lack of proper communication
Ward Councillors	• Poor representation • Lack of understanding community needs
Civic Organisation Leaders	• Poor distribution of resources • The rising rate of unemployment • Poor access to education and training
School Principals Representative	• An increasing number of learner dropout • Lack of proper facilities at home
Religious Leaders Representative	• The increasing use of substance abuse • High unemployment rate • An increasing number of women and children abuse
Security Cluster Representative	• Increasing crime • Concern for safety and security

Community Stakeholders	Community Needs
Thusong Centre Representatives	• Small venue • Access times • Limited usage of the space
Business Organisations (small and large)	• Lack of employment • Declining economy • Lack of skilled labour
Farming Communities	• Seasonal jobs • Drought affecting jobs • High transport costs • Meagre remuneration

Response to SRQ 1

The data analysis process in the previous sections indicates that ICT development in rural and underserved communities is a work in progress – one that is taking place at a snail's pace. The interpretation of themes provides the following summary of causal reasons for why the rural and underserved community do not benefit from CI:

i) There is no synergy between the community, government and the private sector.
ii) The community is disjointed and has no structures to articulate their ICT needs.
iii) The ICT developers and providers do not have the interest of the rural and underserved communities at heart. There is no user involvement or participation.
iv) There is no consistent methodology for the implementation of community-based ICT projects.
v) There is no project management, planning and direction for rural and underserved communities.

The above causal reasons for the lack of development in rural and underserved communities continue to challenge the use of ICT resources in these areas. A strategy is required to increase the participation of these communities in ICTs. However, the government is expected to prepare the ground for the proliferation of ICT projects.

6.5.2 DSR sub-cycle 2 theme discussion

The next two clusters of themes to be addressed emerged during DSR sub-cycle 2.

6.5.2.1 Theme 9: Government enterprise architecture

The government participant (P30) defined EA in government as the alignment of ICT with government business (Appendix M): "Our government is developmental. It should mobilise societies, bringing in economic resources to its citizens and eliminate poverty. The government is struggling to meet the developmental goals as stipulated by the United Nations". P24 claimed that the "diverse origins and definition of EA have had an impact on offering the universal implementation of EA. The WCG Governments captured EA in its imaginative way". P21 explained the government EA status in the WCG as follows:

> "EA has never really taken centre stage within the WCG. The Centre for e-Innovation is responsible for enterprise architecture (EA) development project for the WCG. There are so many definitions, and interpretations of EA branded around. Some call it an e-Government strategy, some the national government term of government-wide enterprise architecture (GWEA), some remove the character 'w' and call it Government EA (GEA). Hence, these multiple ways of defining EA. EA, although a relatively new disciple, has numerous ways of describing it. Sometimes, it feels that new definitions are made to identify a unique situation…" (Appendix M).

P22 claimed that the "WCG authorities allow municipalities to influence the WCG EA structures. The influence may not necessarily follow EA blueprint or template but designed to respond to the needs of the community" (Appendix M). P20's different view was that the "WCG government decides on behalf of the community what they need, hoping that the community will accept with favour the government decisions" (Appendix M). P23 responded as follows: "I can tell you what the biggest problem that we have in government... is – the government delivering services to the citizens" (Appendix M). P23 further said that the "government think[s] for the citizens what they should have... the government writes on behalf of the communities policies that they think will impact on the people" (Appendix M).

P24 explained that the "e-Government for Citizen program[me] is meant to address community insights" (Appendix M). P22 supported this claim by saying that "while the provincial government is not implementing EA as it should, it does implement an 'e-Government for Citizens' programme which looks after the "provincial governments' portals, and Intranets". P22 further added that "within the system, a user experience and design component for process design and user testing plays a role in ensuring that user's need and aspirations are taken care off" (Appendix M).

The provincial and the local governments demonstrated that government EA could contribute positively to community development.

Sub-theme 9.1: Administration

P22 opined that the government "has a critical role in setting an administration that responds to the needs of the people. The people's government will demonstrate a caring attitude that provides solutions to the problems experienced by the communities" (Appendix M).

It is the people who decide, and the government that leads the process of change. This sentiment was expressed in the interviews because of the view that government administrators do not care much about what the rural and underserved people feel.

Sub-theme 9.2: Architectural construction

P23 argued that the actual architectural planning should reside within the community. The community should state what they want, when and how they want it. P23 argued that architectural work has its origins within the communities. EA was implemented in the communities, even though today organisations have a significant hold on it.

6.5.2.2 Theme 10: Enterprise architecture construction

Even though the architectural constructions and the views were the community's view, the actual building of the EA should remain with government offices. P23 argued that the government should provide the architects who would work with the community to build a system for the community. The community's participation authenticates the EA.

Sub-theme 10.1: EA Strategies

P11 stated that the "EA strategies are required to ensure that rural and underserved communities are assisted in ensuring that issues of interoperability, integration and opportunities that EA promises are fully engaged and supported". EA has a wide range of strategies that can uplift communities.

Sub-theme 10.2: EA Modeling

The participants stated that how EA is structured and implemented, makes it possible for the government and community to work together to build a community EA. P11 said that, "EA has business architecture, application architecture, technical architecture and information architecture, all of which makes it possible to model the rural community to improve the way of living".

Response to SRQ 2

What has become apparent from the exploratory thematic analysis in section 6.3, is that the government requires more focus on government EA, concentrating on the formation of partnerships with the rural and underserved communities that allow for mutual participation.

The role of the government's EA is to provide a platform for implementing community-based ICT projects. The government's EA needs to be aligned to the community's business goals with respect to an IT platform that holistically responds to service delivery requests in an integrated manner.

6.5.3 DSR sub-cycle 3 theme discussion

In sub-section 6.4.3, DSR sub-cycle 3 brought the intersection of two lists of themes, CI themes and EA themes, seeking commonality between the EA and CI. Participation of rural and underserved communities, the capabilities within the community, community stakeholders and sustainable programmes were overarching themes that could ensure the integration of EA and CI. Eleven points of intersection between EA and CI were identified by the researcher in sub-section 6.4.3.

Response to SRQ 3

The response to SRQ 3 is embedded in the model of integration of the interdisciplinary work. Repko (2011) defines a model of integration that encourages interdisciplinary work using four qualities. The four qualities are used to respond to SRQ 3. These qualities are: (i) a vision of integration; (ii) theory underpinning the integration; (iii) practices necessary to hold integration together; and iv) the knowledge of weaknesses and strength. Sub-section 6.4.3, and in particular, Table 6.14, present eleven integrative themes of EA and CI. The response to SRQ 3 is outlined below.

The vision of integration: The analysis of the data from IT experts revealed that the integration of CI and EA promotes two goals: educational goals and practical, pragmatic integration, focusing on real-world practical and complex problems. P15 said that "for EA to be successful, a huge educational drive and skills training should be effected for both the government and the local government officials throughout the province, then follow it up with small incremental steps of implementation" (Appendix M).

The theory underpinning the integration: The data analysis revealed that learning theories are necessary to support the development of both the government and community skills. These learning theories should underpin the integration of CI and

EA. The community needs exposure to learning theories in order to improve their participation in community development. Government officials need to build their learning capacity to understand the acceptance or rejection of community-based ICT projects.

Practice necessary to hold integration together: The data analysis indicated that CI and EA integration fosters the creative unit of order and synthesis within communities.

The utility of this model focuses on improving skills and on the multiple perspectives necessary to solve a range of complex problems or wicked problems[3]. Repko (2011) argues that any integration model calls for identification of salient interdisciplinary concepts such as power, energy, modernisation, globalisation or progress. CI and EA integration would latch on the salient concepts put forward by Repko (2011) and Szostak (2017).

Knowledge of weaknesses and strengths: The virtue of the CI and EA integration model is its ability to facilitate a comprehensive perspective that is more encompassing and holistic. Integrative models are generally complex to create. Conflicts and competition are hindrances to integration. As difficult as the integration might be, they are but preparatory phases that include creating or discovering common ground, integrating insights and producing a more comprehensive understanding or new meaning. The integrated EA-CI model provides the answer to SRQ 3.

6.5.4 Summary of the themes

The presentation of themes provides the significant overarching finding of the study, which is that there exists a dire need to ensure that rural and underserved communities participate in the development, deployment and implementation of community-based ICT projects that promote community development.

Following this significant finding, another finding that emerged is that rural and underserved communities are not equipped with ICT skills to make decisions concerning the implementation of ICT projects. Therefore, the government must provide education and skills training which responds to the current needs of the community.

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[3] "Wicked problem" was originally defined by Rittel and Webber (1973), as well as Simon (1973) to some extent, as socially and politically difficult problems to define but with good or bad solutions that cannot be classified as true or false.

The next finding is that the rural and underserved communities do not have adequate community stakeholders to encourage the formation of alliances between the community and the government, especially in matters that are ICT-related.

Finally, the community needs to identify sustainable ICT programs that can change the status quo – ICT programs that will sustain economic investments and assist in competing in global markets. This need requires the government and the rural and underserved communities to partner in their efforts towards economic emancipation. Building such a partnership requires a framework that can serve as a guide.

6.6 EA4CD framework: The designed artefact

The section deals with the development phase of the DSR main cycle (Figure 5.11). The phase responds to the main research objective, which sought to develop the design artefact (section 1.5). The conceptual framework in Figure 6.24 shows that this objective is at the heart of this study. The development phase received input from the three DSR sub-cycles (sections 6.2, 6.3 & 6.4) presented in the previous sections:

- The emerging role of CI in implementing community-based ICT projects
- The government's emerging EA role is necessary to implement community-based ICT projects
- The integration of the EA and CI model for the benefit of rural and underserved communities

Furthermore, the SLR (Chapter Two) described EA as an holistic approach, bringing together business processes, information needs, technical needs, personnel and other organisational units in order to provide a solution to the current problems. The empirically analysed data that included interviews, government documents and observations, supported the view of a need for a formal artefact, a framework that brings together the different components within the community to address the needs of the community holistically. Reflection on the thematic analysis of the three DSR sub-cycles, presented in the previous sections, provides the following categorised themes necessary to build an EA4CD artefact:

i) The entrenching of CI principles and activities within rural and underserved communities.
ii) The holistic access to government services through the use of EA standards benefitting the rural and underserved communities.
iii) The integration of community and government activities to improve the living conditions of rural and underserved communities is necessary.

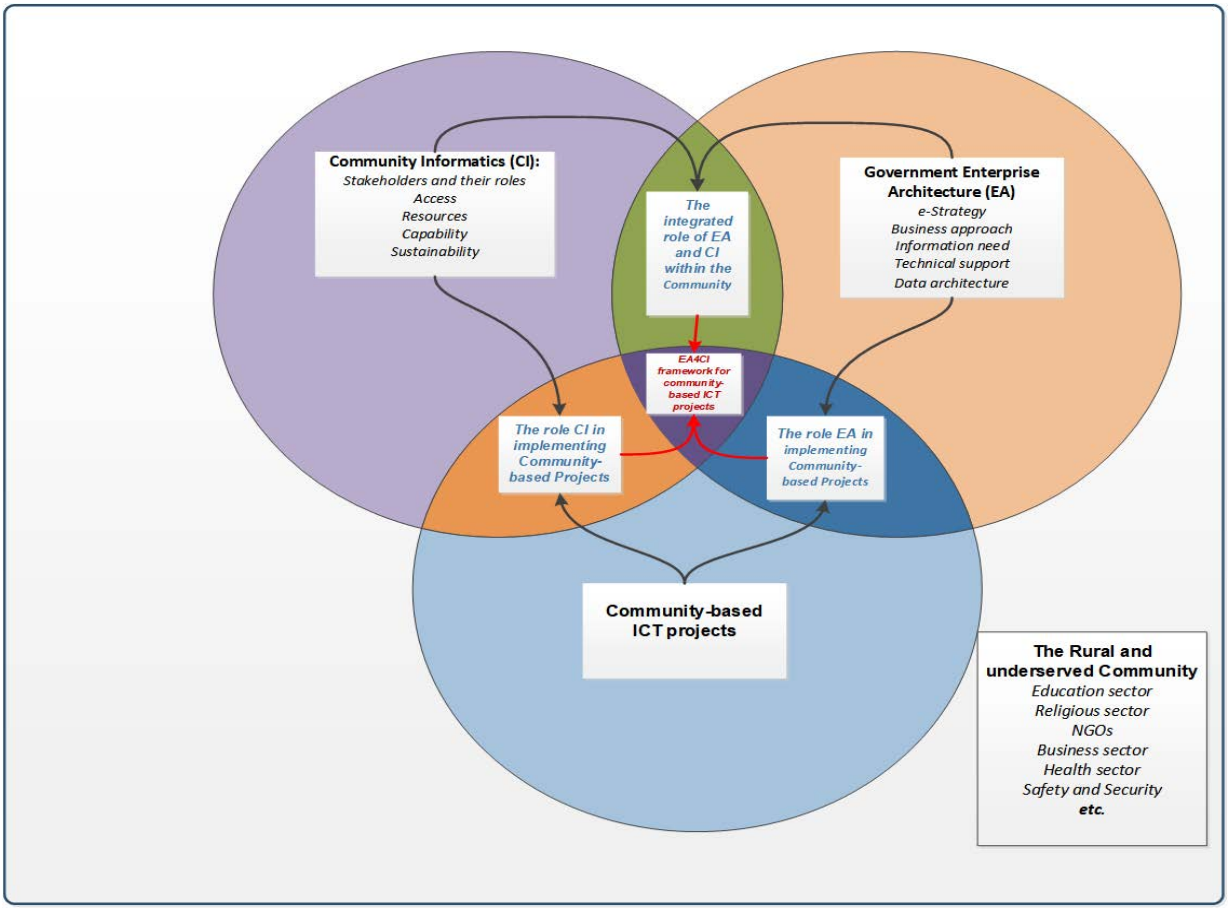

Figure 6.24: Conceptual framework: EA4CD framework for community-based ICT projects

The EA4CD framework emerged from the analysis of primary empirical data and the literature review analysis. This framework aims to provide a platform from which to implement community-based ICT projects as tools or enablers, to address the rural and underserved community's needs. Concepts, assumptions, expectations, beliefs and theories that are defined in the conceptual framework (section 3.6), and which further emerged from the empirical study in this chapter, illustrate an integrated approach to the emerging themes that responds to the needs of the rural and underserved community. The proposed EA4CD framework has four integrated levels of abstraction (Figure 6.25).

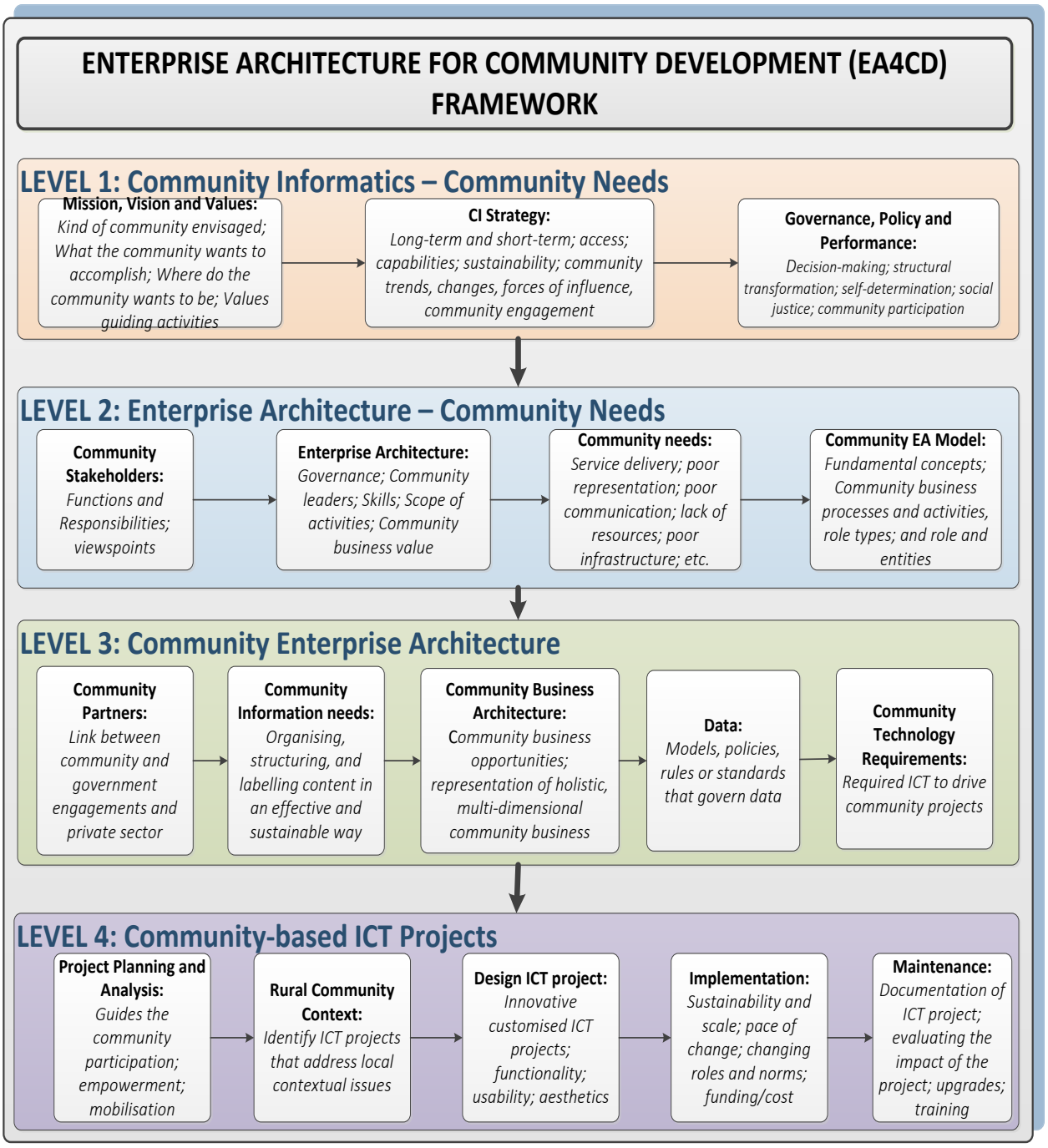

Figure 6.25: Enterprise Architecture framework for Community Development (EA4CD)

Level 1 defines how CI principles can be used to describe a strategy designed to respond to community needs, while **level 2** addresses the envisaged role of EA within the community. **Level 3** deals with the components of community the EA (CEA) model requires to address the community's needs holistically. **Level 4** defines the implementation of community-based ICT projects based on the CEA in rural and underserved communities.

6.6.1 Level 1: Community informatics and community needs

Three considerations emerged as critical in building the EA4CD framework. Firstly, the need to define the community mission, vision and values is essential for the sustainability of the rural and underserved communities. Sustainability means that the community feels free, safe and happy to maintain a lifestyle of choice. This goal is achievable if the community can define the kind of envisaged community ideals it subscribes to. What is the status of the community, and where does the community want to be in the foreseeable future? The community's needs encapsulate the values guiding the existence of the community. With an adequately crafted mission, vision and values statement for the community, the community forum can deal with the *thorny issues* (as one society describes them), such as the allocation of land and business sites, as well as the location of schools and health clinics, to mention a few.

The community members' interview responses indicated that if the community members and the existing community organisation do not coordinate their activities towards finding solutions that speak to their needs, no community gains would be realised. The existing community Stakeholder's Forum articulates this view clearly. This forum, which represents the vast majority of organisations in Grabouw, establishes the mission, vision and values that drive the aspiration of the community. However, despite this forum, several organisations need to be recruited to the Forum in order to strengthen the voice of the community.

The second consideration is the need to craft a CI strategy or set of principles to deal with the long- and short-term goals of the community, which manage the use of virtual and physical networking capabilities. A CI strategy seeks to find the balance between long-term planning and short-term activities. This balance will assist communities to understand better what kind of community is required and, thus, help prioritise the community needs.

It is through participation and identification of community capabilities that the community can respond to the current challenges. CI adopts the mission, vision and values of the community by specifying ICT interventions and development suitable to the community. The study of common trends that affects society is critical in order to map the direction the community needs to take. The required and necessary changes are highlighted and dealt with accordingly. The forces of influence are capable of bringing about meaningful changes in society. CI further establishes community trends by studying the current status as well as the required and possible changes that are necessary. Effects of change are critical in community

development. CI assists in community engagements. In community development, community members take collective action, generating common solutions that seek to improve the quality of life. CI bases its argument on community development, which combines teaching, research and service activism in order to affect changes in the community.

The third consideration includes governance, policy and performance. P4 said the following: “If our community is not governed by people of integrity and love for this community, we are doomed for failure” (Appendix M). Another member of the community (P8) claimed that:

> “If we as the community do not unite and speak in one voice, our aspirations as a community will fail. If each one [NGOs] does his/her own little thing at some corner, we will lose out in community development. Our strength as a community is when we are united. We are weak when we speak in forked-tongue…” (Appendix M).

Rural and underserved communities lag behind because of poor governance, or because of policies that do not cater to the needs of rural and underserved communities. A lack of governance and policy direction results in adverse performance by the officials or in a loss of resources.

In the process, virtuous qualities such as good governance, policy and performance promote social justice, fairness, equity of opportunity and access, and in so doing, it challenges discrimination in all its forms, while valuing diversity. Self-determination restores community dignity, which indirectly restores people’s awareness of their choices. A common approach to working and learning together will guarantee that all community voices are heard, the benefits of which will result in the formation of sustainable activities that empowers the whole community. Participation is critical and crucial in community development, which includes reflection, taking time out to review the work done, and providing an opportunity to chart the way forward. Reflection also reveals corrections and remedial steps.

6.6.2 Level 2: Enterprise architecture and community needs

Actions in level one define the community as an enterprise. The characteristics identified in level one assist the government EA in planning and executing their plans in conjunction with the communities. Level two defines the role of government’s EA in improving the community as an enterprise. The general role of EA is to determine the current “*as is*” state and the future “*to be*” state, thereby identifying and learning how to bridge the gap between these two states. As stated in the literature review in Chapter Two, and which has emerged from the data

analysis in this chapter, EA requires dedicated personnel to advance its implementation. P20's response to the question, "What can EA do for the community?" is as follows:

> "EA can harness capabilities and expertise within society. EA can explain what we now know and have and what we will be needed in the future and the process of getting there. EA pulls together the unrelated and different aspects of the community activities and decides the way forward" (Appendix M).

This level has four considered views on how to build an EA4CD framework. Firstly, the government needs to understand who the community stakeholders are, and what dedicated functions and responsibilities are attached to each community stakeholder. The empirical data analysis reflected in Table 6.2 identifies some of the key community stakeholders in the community. The participation of community stakeholders and the formulation of holistic and multi-dimensional community businesses become guiding principles for the government. Community stakeholders are tasked with finding solutions to the community needs, such as service delivery problems, poor communication processes, lack of resources, poor infrastructure and many more. Using EA concepts, P21 said that this will "lead in identifying EA models such as the formulation of concepts, identification of community business processes and activities, role types and role entities" (Appendix M). Sousa et al. (2007:70) argue that, "the structure of EA is about the structure of the things of relevance in the enterprise, their components, and how these components fit and work together to fulfil a specific purpose".

Secondly, government's EA assists with the governance of the community through consultation with community leaders. This kind of participation avoids the temptation to dictate and think for the communities about what they can have or not have. Since the government holds resources for communities, they negotiate the scope of activities with the communities with respect to the training and upskilling of community members that is required.

The third consideration is a government EA that responds to the community's needs such as service delivery, poor communication, inadequate representation, lack of resource and lack or poor of ICT infrastructure. The government must know precisely how they will deal with such issues.

The fourth consideration is the building of the government-community EA model. The fundamental concepts that explain this model are the community's needs and the community's business proposition. Communities express community needs,

while community business propositions are outcomes from level one. The government's EA process results from input from the community responding appropriately.

6.6.3 Level 3: The Community Enterprise Architecture (CEA) model

The third level builds the community EA (CEA), based upon establishing community linkages, community information needs, community business architecture, data models and community technology requirements. CEA is implemented and owned by the community.

Community partners: The data analysis themes of integration of community and government activities, which aim to improve the living conditions of rural and underserved communities, is a simplified version of concepts that define the relationship between the community and the government. The CEA model describes the process of how rural and underserved communities can coordinate community business activities and ICT infrastructure in order to realise the community vision. Furthermore, the CEA model realises that community partners are necessary in order to achieve the community vision. The triad engagement between the community and local and provincial government better provides the community with the strength to understand what the community's needs are, instead of the government imposing unnecessary and irrelevant technology upon them. The other important alliance is between the private sector and the community. There is a need for big business to match the community's aims, goals and objectives.

Community information needs: A community's information needs should be organised, structured and labelled effectively and consistently in order to advance community businesses. Information should be available on-demand to assist with addressing the mission, vision and values of the communities.

Community business architecture: The community business architecture defines the service strategy, the function, the outcome, the process of information and the geographic location of the business context and environment.

Data: The process results in defining data models, refining policies, and determining the rules and standards that govern the use of data in addressing the community needs.

Community technology requirements: Community ICT infrastructure and platforms that match the community needs are set up and determined.

6.6.4 Level 4: Community-based ICT projects

The fourth level continues from the three previous levels. Since the establishment of the CEA model, the design and implementation of community-based ICT projects operate in a defined contextual environment in the following stages:

Project planning and analysis: Project planning is generally relegated to the use of Gantt charts to identify the milestones of the project. Project planning in community-based projects is a crucial step in that it guides the different developmental phases of the project, building from start to finish. It also encourages participation by, and empowerment of, the community. Significant direct benefits that stem from project planning, such as transparency, are important ingredients for trust and respect. Project analysis also encourages participation. Through the study of time, cost implications, change management and risk analysis, the community's brainpower is galvanised into working together. ICT projects are enablers and tools for development that o get the developers and end-users to communicate with one another through the lifetime of the project.

Rural community context: It emerged from the data analysis that the context in which the ICT project exists was crucial in determining its success. The cultural setup, including the local dialect, contributed to community development. Without a doubt, interviewees felt that the implementation of ICT projects could provide them with an enabling environment, providing a societal solution. For example, in response to the question, "What will the benefits of ICT be?" P25, a policeman, responded that "ICTs are good tools for fighting crime" (Appendix M).

The community responded that ICT projects should enable the following areas:

- Good health and well being
- Quality education
- Gender equality
- Decent work and economic growth
- Industry, innovation and infrastructure
- Sustainable cities and communities
- Climate changes
- Peace, justice and strong social institution

ICT design and implementation: The design and implementation of ICT projects in rural and underserved communities was a delicate matter, as people involved do so out of desperation. The design and implementation phases become crucial in ensuring sustainability and the scaling of the project. ICT design in rural areas is

specialised because it has to take into account the available, and largely inadequate, ICT infrastructure, which is often situated in rough and dense terrain. From the data analysis, it emerged that the following stages are required:

i) *System architecture*: Well-defined system architecture sets the boundary of the system.
ii) *The principal objects in the system:* The functionality that defines how the different objects interact with each other.
iii) *Design model:* Design model is a bridge between the system's requirements and the implementation of the system. There are two types of design models: the structural design model, which defines the static state of the system and the dynamic design model, which describes the dynamic state of interaction between a system's objects.
iv) *Interface:* Interface to the system is crucial since it determines how the different components of the system are accessed.

Great care is required to draft detailed specifications that emphasise real solutions to a rural and underserved community's ICT challenges. It is not only the physical structure necessary to address the needs of the community; the solution should address matters of the heart that would liberate and empower individuals in the community.

The implementation phase should consider the project initiation, planning, execution and monitoring, and controlling of the ICT system.

Maintenance: The systematic evaluation of the impact of the ICT project is crucial as this evaluation determines what maintenance is needed. The necessary upgrades and training keep the rural communities enlightened, while enjoying the benefits of the technology. Changes are inevitable; the pace of change, wrought by the changing roles and norms, means that maintenance must take place at regular intervals.

Documentation describing the manner in which the ICT project progresses needs to be readily available for review and maintenance.

6.7 Summary

In this chapter, the researcher presented the empirical evidence of the research study. The study aimed to explore how the integration of CI and EA could improve the development, deployment and implementation of community-based ICT projects in rural and underserved communities. The empirical study unfolded the three stages, which culminated in designing the EA4CD artefact framework.

Firstly, the results of investigations on the roles of ICT and CI in implementing community-based ICT projects were presented. Anecdotal evidence showed that ICT is a tool and enabler in CI. The researcher demonstrated that CI was critical in stirring the community into active participation in efforts to change their unsustainable living conditions using ICT.

Secondly, the role of government's EA in the planning, design and deployment of ICT and government business in order to alleviate the living conditions in the rural and underserved communities was discussed. From the presented empirical evidence, the researcher has found that government needs to incorporate the rural and underserved communities as their partners when creating ICT policies and strategies.

Thirdly, the researcher found that the integration of EA and CI disciplines, two well-established disciplines, were imperative to ensure that rural and underserved communities participate actively in the design and implementation of ICT projects. The researcher has found that the empirical findings of CI and EA characteristics were critical to the finding of ways of integrating CI and EA, paving the way for the design artefact – the EA4CD framework.

In the next chapter, the researcher presents the evaluation phase of the designed artefact and discusses further findings.

CHAPTER SEVEN: EVALUATION OF THE ENTERPRISE ARCHITECTURE FOR DEVELOPMENT (EA4CD) FRAMEWORK

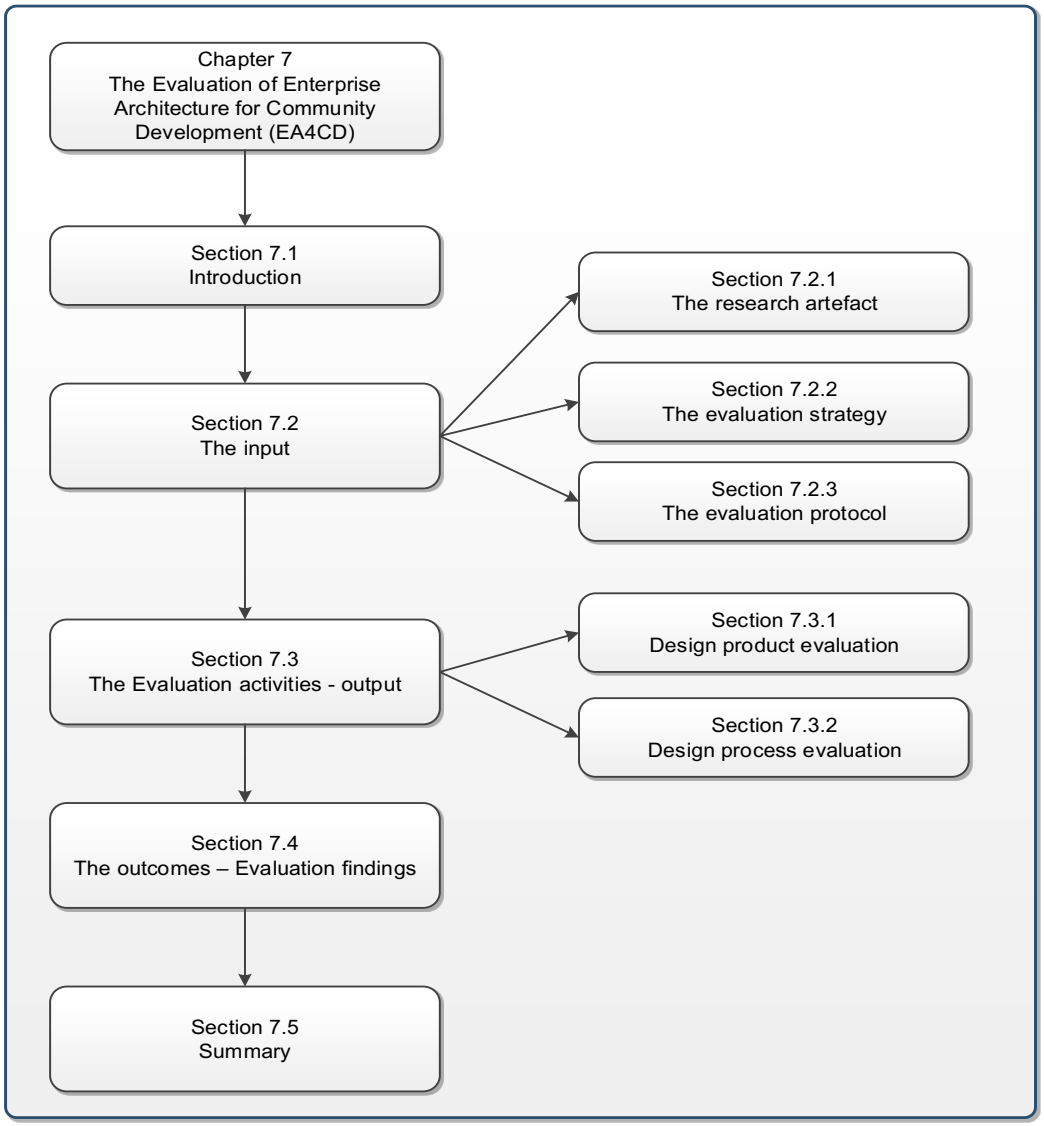

Figure 7.1: Chapter Seven flow

7.1 Introduction

In the previous chapter, the researcher presented the empirical analysis of data obtained in the study. The result of the analysis of the data is the creation of the four-level design artefact, the EA4CD framework, which can be used to implement community-based ICT projects for rural and underserved communities.

As stated previously (section 5.10), the DSR process that was used to develop the proposed framework is a cyclic process that builds artefacts and then evaluates the artefact in order to test it, reflect on the outcome and report on it. In section 5.12, the researcher introduced the fourth and the penultimate phase of the five phases (Vaishnavi & Kuechler, 2015), as shown in Figure 5.8, known as the evaluation of a

DSR artefact, namely the EA4CD framework. Tables 5.5 and 5.6 assisted the researcher with selecting the evaluation strategy and method use, respectively. In this chapter, the researcher evaluates the EA4CD framework (designed artefact) in context in order to determine its validity, fitness for purpose and utility (Gill & Hevner, 2011). Validity means that the designed artefact is premised on its environment. Fitness for purpose is demonstrated over time, as the designed artefact become more settled, fulfilling its purpose. The utility of the artefact determines the close relationship of usage between the designed artefact and the users.

Socio-technical design artefacts require care and effective evaluation strategies in order to identify risks that may cause harm. Cronholm and Göbel (2016) argue that IS DSR, in general, needs several evaluation episodes, spread out during the design cycle. Figure 5.9 illustrates the various evaluation episodes required, spread throughout the DSR process (Sonnenberg & Vom Brocke, 2012). It is more critical for socio-technical design artefacts, where utility/benefit continues in real situations over a long period (Venable et al., 2016).

In this chapter, the researcher follows Shrestha et al's (2014) three phases of communicating DSR evaluation, as shown in Figure 5.10 and discussed in section 5.10. In section 7.2, the researcher deals with the input of the evaluation process, revisiting the nature of the designed artefact and the evaluation strategy. In section 7.3, the researcher discusses the evaluation activities involving the designed artefacts and designed process. The evaluation findings are discussed in section 7.4, concluding with the chapter summary in section 7.5. The artefact has not been evaluated in the community because it needs to be aligned to the community's language and understanding of the concepts.

7.2 The input

This section deals with the three inputs of the evaluation process necessary to process the evaluation strategy. These inputs include the designed artefact, the evaluation strategy, and the evaluation protocol.

7.2.1 The research artefact

In section 6.6, the researcher provided an in-depth description and the development of the EA4CD artefact. Mwilu et al. (2016) classify artefact type, EA4CD, as a model or a logical structure for organising complex information into a framework. The framework responds to challenges of exclusion or lack of participation experienced by rural and underserved communities. The four-level integrative EA4CD framework

determines the extent of the effectiveness of solving the problem for which it is recommended. In this study, the main objective of the DSR was to state how EA4CD guides the development, deployment, and implementation of the community-based ICT projects with a view of improving the living standards in the rural and underserved communities. The objective of the artefact is now evaluated to determine whether the technical feasibility within the problem space conforms to the interests and the concerns of the community.

7.2.2 The evaluation strategy

In Table 5.8, the researcher presents four evaluation strategies, namely: (i) quick and simple strategy; (ii) human risk and effectiveness; (iii) technical risk efficacy; and (iv) the purely technical artefact, as a lead up to the formulating an evaluation strategy. The human risk and effectiveness evaluation strategy is appropriate for this evaluation because the artefact is based on serving human beings with possibly unpredictable human nature. As the artefact becomes more entrenched and embedded within the society, human risks are expected to increase. Formative evaluation assessments, as the artefact is built, are likely to provide an understanding of possible human risks. In addition, as the artefact becomes more mature and stable, summative evaluations become necessary. Venable et al. (2016) propose that the human risk and effectiveness strategy best suites this type of evaluation because of the social-technical and user-oriented nature of the design. In addition, using the artefact will benefit a real user in a real situation over a length of time.

Community members and WCG officials were purposively and conveniently sampled (section 5.5.1) to participate in the evaluation process. The evaluation process involved three focus groups comprising the community leaders or stakeholders, WCG officials, and the combination of both the community and WCG officials. This intention failed as it was challenging to get the three focus groups under one roof, so, individual interviewees were sought. Five community members and two WCG IT experts took part in interviews. The five community members were an educator, an NGO leader, a police officer, a crèche manager and a councillor. The community members represented community stakeholders who could articulate the community's ICT interests. The WCG IT experts were part of the senior management team based in the provincial offices. These experts had an overall understanding of how ICT works within the province.

7.2.3 The evaluation protocol

This study reports on the 'build-evaluate' cycle of the design. Pries-Heje, Baskerville et al. (2008:89) argue that the *ex-ante* evaluation "provides for theoretically evaluating a design without actually implementing the material system or technology". Sonnenberg and vom Brocke (2012) claim that the *ex-ante* evaluation process communicates the evaluation result before actual implementation. The *ex-ante* evaluation process deals with timing, evaluating the artefact during the design phase (Pries-Heje, Baskerville et al., 2008:89). In addition, Venable et al. (2016) suggest two methods characterising the evaluation process, namely the artificial and the naturalistic method. Even though artificial evaluations are predominantly positivist in nature, they can also be interpretivist when the intention is to understand better why an artefact works (Venable, 2006). Naturalistic evaluation explores the artefact in its real environment with real people, embracing their complexities (Venable et al., 2016). This setting is critical as it provides a real test of the artefact in a real context.

The evaluation took place during the building phase of EA4CD in order to strengthen the current iteration of the artefact. At this stage, a number of iterations had already taken place. This is an *ex-ante* evaluation, which took place during the design stage, as illustrated in Figure 5.9. Table 7.1 demonstrates the evaluation protocol used in this study.

Table 7.1: Evaluation protocol
(Adapted from Shrestha et al., 2014:5)

Evaluation	Evaluation setting	Evaluation method	Evaluation focus	Evaluation instrument
Design product (EA4CD artefact)	Ex-ante, naturalistic	Interviews	Semi-structured interviews	The hierarchy of criteria for IS artefact evaluation (Prat et al., 2014)
Design process (Research method)	Ex-ante, artificial	Alignment with DSR guidelines	DSR methodology	Hevner et al. (2004) DSR guidelines

7.3 The evaluation activities – outputs

Walls et al. (2004) argue that an evaluation strategy consists of the evaluation of the design product, EA4CD in this case, and the design process, the DSR process.

7.3.1 The design product evaluation

The EA4CD design product was evaluated according to the evaluation protocol stated in Table 7.1. *Ex-ante* and naturalistic processes underpinned the strategy, as described earlier. The evaluation method involved a semi-structured questionnaire.

For the evaluation instrument, Prat et al. (2014) provide a holistic view of IS evaluation along the system dimensions. Gregor (2010) states that IS artefacts are either systems or they are involved in a system. Simon (1996) views IS artefacts as complex systems which are difficult to evaluate. However, Prat et al.'s (2014) holistic views of organising evaluation criteria along five dimensions of systems, namely goals, environment, structure, activity and evolution (Figure 5.10), made the design product evaluation possible.

The artefact evaluation analysis process continued as follows:

7.3.1.1 Goal

The researcher probed further to establish whether EA4CD met the intended goal. Three criteria were applied to determine whether the goals were reached, namely efficacy, validity and generality.

a) Efficacy

The community participants were asked to study the hand-out description of the designed artefact, the EA4CD framework (Figure 6.4), and respond whether they thought the design objective, that of providing a platform to implement ICT projects for rural and underserved communities, had a reasonable chance of success. P1's response was that "rural and underserved communities need to speak in one voice, combining their efforts into a single voice for them to be heard" (Appendix M). P3 responded by saying that "if this is initiative to ensure that communities are not left behind in important decisions that involve their lives, then we are on the right track. Let's go for it!" (Appendix M). All community participants articulated this interviewee's sentiment. They viewed the framework as a "positive step in the right direction", producing the intended results for developing and deployment more ICT solutions within the community.

Both P6 and P7 welcomed the initiative to implement the EA4CD framework. The framework ensured the participation of the rural and underserved communities. The WCG IT officials felt that the framework would add impetus to addressing problems unique to rural and underserved communities. P6 said:

> "Every initiative to get the public own an ICT process and participate in it is welcome. We have been taking decisions on behalf of the communities. There has not been any input received from the communities. IDPs form the communities are supposed to inform us what the community ICT needs are. But, I guess, issues of bread and butter take centre stage. I am happy to see the initiative. Please keep me posted if you take this matter further."

P7 had similar sentiments, but stated his concerns about government's EA:

> "While this design is important in ensuring participation, I am just concerned about the state of EA within the government. Yes, there are initiatives to kick-start EA, but they are not backed up by the national government and we, at the provincial may decide to implement our own EA, while the government has good intentions but not moving. We need to get our act together for this to happen."

b) Validity

Responses to questions of validity and reliability (Appendix M) emphasised the fact that that EA4CD framework held promise that the designed artefact would work. Both the community and the government were positive that the designed artefact would work correctly to achieve the desired goals and embrace reliability. The EA4CD framework is a reliable instrument designed to sustain ICT projects that would benefit the community. The placement of EA4CD within the community places the framework at the 'face of the community'. The more the framework is used, the more validity and reliability will be achieved. In addition, Carter et al. (2014) argue that for validation to take place there must be different methods of triangulation. These methods include method, investigator, theory, and data source triangulation. These types of triangulation were observed when participants were interviewed.

P1 commented on validity and reliability as follows: "This framework is valid because it addresses our current concerns. It talks to the people's needs and addressing their daily struggles and aspirations. Its reliability will be ascertained as the framework takes effect". P2 said that the "approach for designing this artefact is fascinating and exciting. It raises dialogue on different fronts, and this is participation at its best". P6's comments centred on reliability: "The government encourages inclusivity and participation, especially by those we seek to assist. Knowing what our users' priorities propels us to do our best. However, there is still more work to be done". P7 said:

"We have always put our users at the centre of all our ICT system in this province. Cape Access is a testimony to that. So, we are called eGovernment for Citizens. We look after *ehm* the provincial governments' portals and Intranets. So, all of the government information services *ehm* we haven't quite gotten into transactional work. We have a user experience and the design component where we look a lot of process design, user testing and *ehm,* so it's, again we have our foot in the citizen space and foot in the public servant space that we understand both audiences, both are incredibly diverse, but that's from wireframe and through to build that we are able to respond to as many queries as possible new tests afterwards, that we, that's

everything we build is as usable as possible, e*hm,* which is always not the easiest thing to do. But it's an iterative process, and we consider our work of interest. Yes, indeed, I see validity and reliability in this work" (Appendix M).

c) Generality

Both P6 and P7 agreed that the designed artefact could be generalisable and useful to similar rural and underserved communities faced with the same challenges as the challenges faced by the TWK communities. Challenges facing rural communities are similar. The triple challenge of poverty, inequality and unemployment are experienced by a large number of communities in South Africa. P7 said that it would be "a great idea to have this artefact producing the desired results for all our rural communities. Having said that, I believe that this framework is indeed generalisable" (Appendix M).

7.3.1.2 Environment

The environment implies the context setting of the designed artefact. The context of rural and underserved communities provided the platform for the evaluation of the designed artefact. Three critical attributes defined the environment in which this study took place. The first attribute is consistency with the rural and underserved people. The issues that define consistency are utility, understandability, ease of use and ethics, all of which determine consistency. The second attribute is consistency with the community organisations, analysing utility, and fitting well with the community organisations within the environment. The third attribute is consistency with the current technology, compared with what is envisaged in the future.

a) Consistency with people

The community participants and the WCG IT officials agreed that the designed artefact was reasonable to understand, easy to use and did not violates the human rights of anyone. P2 said that in a democracy, "everyone has the right to express their views, feelings and wishes in all matters affecting them, and to have their views considered and taken seriously". P7 said that, "people are at the centre of all government programs". The right to be heard and to speak with the participants promotes a consistent and stable environment. The artefact allowed people, as individuals or collectives, to express their ambitions in life without fear of intimidation. A community member (P4) expressed the detriment of not being heard, or being misunderstood or led by the populist ideology. P4 said that their community "is so much dependent on external populist ideas and sources that will drive a populist ideology without calling for collective reasoning. The government has a tendency to push the ideological stance without involving the community. This kind

of behaviour results in protest actions, burning of facilities, barricading of roads" (Appendix M). This view demonstrates the negative effect of not being consistent with the people within an environment.

b) Consistency with the organisation

The participants agreed that the EA4CD framework was consistent with the government's ICT user-centred strategic policies. P7 said that the "purpose of any e-Government strategy is to include all citizens so that they can benefit from the opportunities offered by digital technologies to improve their quality of life" (Appendix M).

P2's response to digital inclusion was that "the government is not serious about digital inclusion. The poor are at the end of the queue. The affluent are served first, then the rural and underserved will follow" (Appendix M).

P5 argued that the "government should offer ICT training for community organisations such youth societies, women's groups, and sports clubs. You can also get a rival political organisation into ICT training. Most organisations in Grabouw are in the early childhood development (ECD) sector. They need ICT training" (Appendix M). P4 argued that the "EA4CD framework has the potential to unite community organisations. It will provide solutions to immediate and current problems. This framework is understandable. Communities have been struggling for too long" (Appendix M).

c) Consistency with technology

WCG officials felt that the EA4CD framework has a critical role to play in rolling out broadband technologies in rural and underserved communities. The WCG is working on its EA initiative. P6 indicated that the "WCG has a board named Provincial enterprise architecture which is charged with EA matters. The EA4CD can serve in that committee. The EA4CD framework calls for more consistency in using technology to reach out to the communities" (Appendix M).

7.3.1.3 Structure

The designed artefact has a defined structure. The questions that need to be answered are as follows: "Is the structure complete, simple, and clear? Is the style, homomorphic, level of detail, consistency clearly articulated?"

The responses received from the community participants and from WCG officials were unanimous in agreeing that the EA4CD structure is a simple structure with four integrative levels, which are sub-divided into smaller manageable categories. For

example, P6 said that, “EA frameworks are structured and can be simplified for laypeople” (Appendix M). P7 meant that they “only need to simplify the EA jargon” (Appendix M). P4 said it is “comforting to see that EA4CD framework is something you can read and understand. The structure is not complicated” (Appendix M). The EA4CD framework follows a progressive style of levels, starting from easily manageable steps of defining mission, vision and community values to that of maintaining community-based ICT projects. The EA4CD framework is of similar form to structures that attempt to define a geographical community, i.e. homomorphic.

7.3.1.4 Activity

In this dimension, the functionality of the designed artefact was probed. Completeness, consistency, accuracy and performance are all critical to ensuring the usefulness of the artefact. The community participants and WCG officials perceived the structure as complete and functional. P5 contended that, “all the role players are part of this initiative” (Appendix M). P7 said that the “activities of the framework are incremental and consistent with a developmental approach. Accuracy and efficiency of activities with the framework are clear and measurable” (Appendix M).

7.3.1.5 Evolution

Robustness brings about the ability to respond adequately to the changing influences of the environment. Learning capability is the capacity of a system to learn from its experience and its reactions to the environment. All participants responded that the EA4CD framework is robust and provides a learning experience for both the community and the government. For example, P1 said that “if someone is taken through Level 1 to Level 4 of EA4CD, at the end of the day you will have learnt something worthwhile and how to respond to ICT issues” (Appendix M). P3 agreed. P6 stated that, “even the government will learn how to respond to different needs of the communities. Participation is the key to robustness and growth” (Appendix M).

P7 responded as follows: “EA4CD is easy to apply with actual steps or levels to follow and measure. Each level is measurable. For example, in Level 1, there are measurable outcomes – the statement on the vision, vision, and values. In Level 2, for example, EA needs to clarity on governance, service delivery, and community business processes”. The official also felt that the EA4CD framework fits in well with the government’s objectives of improving the ICT in rural areas. The government’s CIT plans are to connect municipality officials who agreed with the ease of functionality. “There are no ICT big terms in the framework; the framework speaks to

the ordinary councillor and to the layman on the street" (Appendix M), said the P7 official.

The issue that pertains to evolutionary growth is sustainability. The interviewees demonstrated an acceptance of the EA4CD framework. P2 stated that the "frameworks will make a huge impact on the communities. Our communities do want to be computer literate. This framework is a way of giving them space to participate and feel included in the events of our local government" (Appendix M). P6 stated the following: "This framework will be a breath of fresh air to both the government and to the community" (Appendix M). P7 pledged support for this initiative by saying that "the added value of this framework will be the poorest of the community who added into the digital economy" (Appendix M). Even if the government does not realise the full benefits of EA, attempts are in the pipeline to standardise the WCG departments.

Both P6 and P7 reacted positively to such an approach because it addresses the SDG goals. It reduces the digital divide by motivating communities to engage with ICT projects that will uplift them. Sustainability is supported by three main pillars, namely, economics, environment and social. P6 said that the "framework should be economical and is possibly implementable in social rural and underserved areas. It does consider the contextual environment. It is sustainability and should provide a possibility for the future" (Appendix M).

Nunamaker et al. (2015) suggest that (i) proof-of-concept; (ii) proof-of-value; and (iii) proof-of-use could be applied to determine whether DSR achieved rigour and relevance in its activities. The community and government's viewpoints were sought on each of the three points. While Venable et al. (2016) agree that the goals of the evaluation should be based on relevance and rigour the evaluation research process should be sensitive to uncertainty, risk reduction and ethics. Uncertainty and risk reduction identifies human social activities that define the designed artefact as not fitting to their social stratum, and the technical risks that consider that the selected technology may not work in a particular environment.

Firstly, the proof-of-concept research demonstrated that the artefact is functionally suitable to solve an essential class of problems and thus suitable to develop a more profound and broader understanding of the class of problems. For example, P5 said that, "If ICT crime-busting programs and apps can be developed with EA4CD framework, then the crime can be reduced significantly. Similarly, gains can be realised in other entities" (Appendix M). P3 saw an opportunity for business by expanding market areas through the community-based ICT projects.

The unemployed living in this community saw better prospects of seeking employment with the introduction of ICT infrastructure. All these responses, and several others, provided the proof of concepts required to show the rigour and relevance of the EA4CD framework, the development of which is necessary to ensure community participation in finding solutions to a class of problems. Rural and underserved communities demonstrated an utmost need to improve their immediate situation. P6 and P7 viewed EA4CD as a step in the right direction. “An attempt to involve the community will always be welcomed. The government should work with people, not for the people” (P7, Appendix M). P6 said: “Taking EA strategies to the people is an interesting idea because all we know is that EA has been implemented from the government offices” (Appendix M).

Secondly, proof-of-value research builds on a proof-of-concept to describe and deepen the quest of the knowledge required to change the current situation. The critical question is, “How can EA4CD work to improve the current conditions within the community?” According to Noble and Smith (2015), the required responses will provide a generalisable solution for the stated class of problems. Furthermore, the unintended consequences emanating from costs, technicality and operational features could deliver a test for efficiency.

The EA4CD framework is a new concept, so its development is mostly explorative, which means uncertainty of completion or risk of partial failure. The goal, therefore, is to identify and address design uncertainties and risks. Two identified uncertainties and risks are critical to this study. The community expects the local government to initiate an inclusive process that ensures communities participate fully in design, deployment and implementation of ICT projects. Community stakeholders and leaders sought external solutions. According to P1, “the government is not as responsive as it should. They do very little for this community”.

Thirdly, proof-of-use research deals with creating a self-sustaining process of communication and growing a community of practise by codifying the design knowledge gained. Proof-of-use becomes an answer to reduce uncertainty and risks. The researcher observed that the community needed more time together to find each other. The interaction among community members would ultimately change perspectives, drawing the community towards a common goal.

7.3.2 Design process evaluation

It is agreed that the DSR process is iterative and the process has cyclic formative evaluations. The DSR process can have multiple cycles of formative evaluations in order to test and improve the artefact under development as it is built. The process

intends to evaluate if the design process and the applied research methods are aligned, and are rigorous and relevant. Hevner et al. (2004) suggest seven guidelines to ensure that the DSR process is on track (Appendix J). In this study, the Hevner et al. (2004) guidelines were applied, as shown in Table 7.2. The purpose of applying the guidelines was to evaluate the study against the guidelines. The guidelines, shown in Table 7.2, relate to this project, as will be discussed next.

Table 7.2: Design science research guidelines (Hevner et al., 2004:83)

Guideline	Description
i) Design as an artefact	Create an innovative IS artefact in the form of a construct, model, method or instantiation.
ii) Problem relevance	Provide a solution to an essential and relevant business problem.
iii) Design evaluation	Use a well-executed evaluation to demonstrate the utility of the design artefacts.
iv) Research contributions	Research contributions are clear, verifiable, new and interesting.
v) Research rigour	Construction and evaluation of the design artefact is justified using prior theory and evaluation is conducted with rigorous research methods.
vi) Design as a search process	Use an iterative search for an effective solution to the problem.
vii) Communication of research	Communicate the results effectively to technology-oriented and management-oriented audiences.

i) **Design as an artefact:** In this study, an innovative EA4CD artefact for rural and underserved communities, designed to facilitate the implementation of community-based ICT projects was constructed. The EA4CD is beneficial to the community. The WCG will better understand the needs of the community through this artefact.

ii) **Problem relevance:** The question why the rural and underserved communities continue to experience the 'digital poverty' when technology has advanced has brought relevance to this study. EA4CD narrows the digital divide. It addresses the costly ICT services that hinder progress in these communities. The solution to this problem addresses the heart of the problem, namely a triple challenge of unemployment, inequality and poverty.

iii) **Design evaluation:** Evaluation in DSR is an ongoing activity. As the artefact is built, evaluation continues. EA4CD is going through formative evaluations. Once the artefact is fully designed, summative evaluation takes place.

iv) **Research contribution:** This study contributes to the creation of an EA4CD framework. The artefact has a clear, verifiable and relevant goal for both the community and the government.

v) **Research rigour:** The construction of EA4CD followed tried and tested research methods to ensure rigour. The DSR methodology, including the research paradigm, data collection methods and data analysis methods have been used before. Philosophical assumptions and theoretical knowledge supported the construction of the artefact. Two critical steps denote rigour in DSR evaluation. Firstly, demonstrating the feasibility of the artefact and secondly, providing an assessment of how well the artefact works. The design and evaluation of the EA4CD approach included a careful justification of each step, using standard guidelines (section 7.2.1), theoretical insights (section 3.6) and evidence from the Grabouw case (Chapter Four). As part of the research project, the design, construction and evaluation of the design artefact used established research frameworks.

vi) **Design as a search process:** The search process for the EA4CD design artefact was iterative and reflexive. The process went through several iterations. The search for an effective EA4CD artefact required the use and integration of the EA process and CI as a means of utilising available options to reach the desired EA4CD artefact, while satisfying the principles of laws in the problem environment.

vii) **Communication of research:** A conceptual paper on the integration of EA and CI is due to be published. There will more articles written, presenting the results of this research to audiences that have a keen interest in interdisciplinary studies.

The DSR process is elaborate and requires due diligence in implementation. The seven guidelines ensured a rigorous process, with outcomes that are credible and reliable.

7.4 Outcomes – the evaluation findings

Shrestha et al. (2014) suggest three dimensions of the evaluation process, namely short-term, intermediate and long-term outcomes, as discussed in section 5.8. The short-term outcomes provide the immediate evaluation results, demonstrating that participants are eager to have the designed artefact to improve the current situation (Ibid.). The intermediate outputs provide the evaluation findings, while the long-term outcomes discuss the impacts of the evaluation on the body of knowledge of the

discipline (Ibid.). In this study, since the design artefact is still under construction and the evaluation process is formative *ex-ante* evaluation, this evaluation was limited to immediate evaluation results and a discussion of the evaluation findings emanating from the semi-structured interviews.

Evaluation findings

i) The evaluation of the EA4CD shows that the 'build-evaluate' cycle of the artefact requires more ex-ante formative evaluation episodes necessary to implement community-based ICT projects.
ii) The evaluation design process indicates that more rigour and relevance is required.
iii) The evaluation strategy confirms that human risks are not easy to predict.
iv) The designed EA4CD demonstrates that the community and the government's willingness to work together in challenging the triple challenge in rural and underserved communities may be a challenge.
v) The evaluation of the design artefact and design process reveals that there is no single complete evaluation process.

The evaluation findings indicate the amount of work the build-evaluate cycle entails. It is not a matter of ticking boxes to demonstrate that the designed artefact is complete. It requires a recursive, iterative and reflexive process. It also deals with inclusivity as a much as is possible, both on the community side and the government. The community needs to recognise their role in order to build a better future and the government must accept the main task of governing, which entails participation.

The recommendations emerging from the analysis of evaluation are summarised as follows:

i) The designed artefact, the EA4CD framework, needs further evaluation to consolidate the gains made thus far.
ii) The function of the designed artefact requires articulation to strengthen its utility among the key role players.
iii) The requirement analysis requires further attention in order to understand the needs of the community entirely.

The EA4CD framework addresses the critical question: "Who is doing what, how and when?" The question requires an in-depth, naturalistic and summative evaluation. These evaluations encourage community stakeholders to take ownership of, and to lead the process of, implementation of the EA4CD framework.

7.5 Summary

In this chapter, the researcher dealt with the evaluation process, focusing on a cross-sectional review that represented a snapshot in time. Within this time, the evaluation concentrated on the assessment input and the output explicating the evaluation activities and the outcomes of the evaluation. The input of the evaluation process reviewed the subject of the evaluation, namely the designed artefact, EA4CD. After the review, the outline of the evaluation strategy took unpredictable human nature during the design of the artefact into consideration. This consideration led to the development of the evaluation protocol, which took into account the designed product and the design process. The protocol for both designed product and the design process entailed the setting, evaluation method, evaluation focus, and evaluation instruments.

The designed artefact evaluation instrument focuses on goal, environment, structure, activity and evolution. The goal evaluates whether the artefact meets the intended and desired goal. The environment evaluates the artefact within the context in which it intends to operate. The defined structure of the artefact clarifies, simplifies and makes it easy to understand and evaluate. The evaluation of the activity within the structure brings out the usefulness of the artefact – whether or not it is complete, consistent and accurate, and whether it performs optimally. Evolution takes into account the growth of the artefact, which entails whether the artefact is learning and improving as it grows.

The design process evaluation followed Hevner et al.'s (2004) seven guiding principles of the design process. These guidelines guided the process from straying away from the intended outcome, guarding the design process against pitfalls that may detract from the study.

The outcome of the evaluation is that the 'build-evaluate' cycle needs more episodes of evaluation to strengthen the position of the artefact. The initial evaluation is critical as it kicks starts other evaluations that provide the feedback information necessary to improve the quality of the designed product, while assuring the rigour of the design process. The consolidation of both the designed artefact and the design process builds confidence into the DSR process and invariably contributes to DSR theory.

In the next chapter, the researcher will discuss the contributions made to DSR by this study.

CHAPTER EIGHT: DESIGN SCIENCE RESEARCH CONTRIBUTION

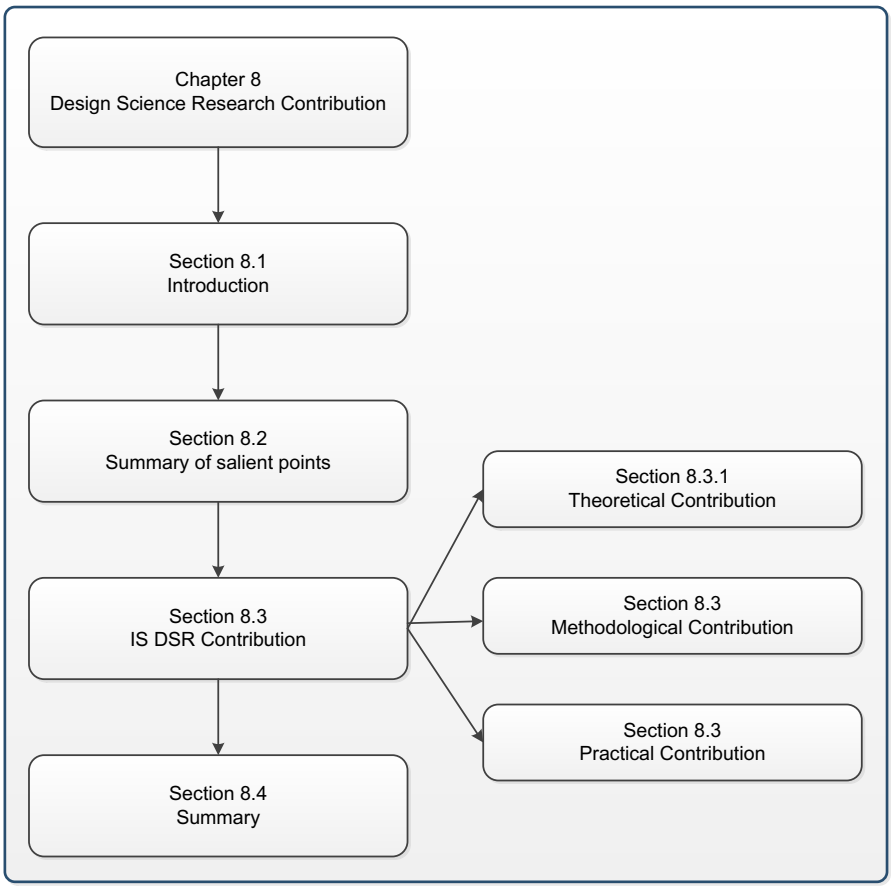

Figure 8.1: Chapter Eight flow

8.1 Introduction

In Chapter Seven, the researcher presented the process of the evaluation of the design artefact. The outcome of the testing and reflection demonstrated the valuable contribution this research could have on rural and underserved communities. Communities need to participate in the improvements of community-based ICT projects. The improvements should not be left to the government or to the private sector only.

In the next section of this chapter, the researcher provides the salient points of this research (Figure 8.1). In subsequent sections, the researcher offers contributions made in this research, followed by the recommendations from the research. These sections will be followed by a section in which the researcher makes suggestions for future research. The penultimate chapter presents reflections on the research strategy/approach. Finally, a summary of the research and a final word will be presented.

8.2 Summary of the salient points (findings)

Since 1990, there has been heightened activity in the field of IS, where several disciplines came to the fore (section 2.3). The purpose of all these disciplines is to integrate the use of ICTs with the goals and objectives of organisations or communities. Chapter 1 demonstrated that despite the heightened activity in the field of IS, contributing to the evolution of ICT, there seems to be areas in the world with little or no ICT evolution. Therefore, the practical research problem statement postulated in Chapter One states that:

> Rural and underserved communities face unique challenges when implementing community-based ICT projects. As a result, these communities are failing to implement community-based ICT projects that can empower them.

The systematic literature review (SLR) in Chapter Two dealt with prior research, demonstrating the progression of ICT4D, EA and CI disciplines, with the sole purpose of addressing a particular need within an organisation or the community. The process of the SLR culminated in identifying gaps in research that require in-depth consideration. A theoretical research gap highlights the missing theory necessary to generate new insights that explain why rural and underserved communities do not benefit from innovative technological advances. The contradictory evidence research gap, emanating from current knowledge, shows that from the past three decades of reviewed literature, there has been demonstrable progress in ICT development, facilitating the creation of a better world for all. Rural and underserved communities have been side lined. There is a need for more empirical research that includes ethnographic studies and case studies. Fulfilling this need can assist in generalising back to the existing theoretical studies and, thus, reducing the gap between theory and practise.

In Chapter One, the researcher articulated the research aim – integrating CI and EA in rural and underserved communities with the purpose of formulating a framework that will improve the development, deployment and implementation of community-based ICT projects. This focus gave rise to the main research question, namely:

PRQ: How can an Enterprise Architecture for Community Development (EA4CD) framework be developed to integrate EA, CI and community needs to assist with the implementation of community-based ICT projects in rural and underserved communities?

Three subsequent secondary sub-research questions, linked to the primary research question, were examined:

SRQ 1: Why are rural and underserved communities not benefiting from CI when implementing community-based ICT projects?

Findings

The rural and underserved communities in Grabouw experience several challenges that distract their attention away from crucial CI strategies. The socio-economic challenges have forced communities to consider a quick and easy solution, a solution that addresses the short-term crisis. As one community member said (P1), "We live one day a time".

SRQ 2: What is the role of government EA in implementing community-based ICT projects?

Findings

The role of government EA is vast. Government should avoid a 'silo' mentality where issues are departmentalised. EA can integrate community businesses and community services with ICT to provide better services to the communities. EA has a crucial role to play in providing a description of the current state of the community and the envisaged future state of the community.

SRQ 3: How can EA and CI be integrated to address community needs in the rural and underserved communities?

Findings

Integration of the two discipline is so critical because it brought two separate worlds together (i.e., the community and the government) to share common interests in order to improve communication and access to information. This integration is realised through the identification of CI and EA attributes that address the needs of rural and underserved communities. The community has needs; and the purpose of the government is to respond to those needs.

Level 1 emphasises the need for the communities to embrace CI in planning the future. CI, as the discipline, is sufficient to embrace community needs. This objective was realised by stating the vision, mission and values of the community. A CI strategy, defining the long-term and short-term capabilities, followed. Governance, policy and performance should be put in place (section 6.6). Level 2 defines who the community stakeholders are, what the community needs are and possible EA strategies to address the needs, involving the stakeholders. Level 3 formulates what is known as community EA, which holistically brings together community partners such as the community, the government and the private sector, the community information needs, the community business architecture, data, and community

technological requirements. Level 4 is the implementation of community-based ICT projects addressing project planning within the rural and underserved community, based on what is covered in levels 1 to 3.

8.3 IS DSR contributions

Theoretical, methodological and practical contributions are the highlights of this research. The research is situated in the growing field of IS. The DSR paradigm, located within the IS discipline, is a solution-building paradigm. Gregor and Hevner (2013:345) argue that DSR contributions can either be (i) *inventions* for new solutions for new problems; (ii) *improvements* for new solutions to known problems; (iii) *routine design*" for known solutions to known problems (no major knowledge contribution); or (iv) *exaptation* for known solutions extended to new problems. In this research, the DSR contribution is classified as **exaptation**, because of the proposed new solution – the EA4CD framework – extended from the two known disciplines that were applied to a new continuous problem. In other words, both the EA and the CI disciplines are known and adapted (or exapted) to provide a unique solution, namely the EA4CD framework.

Whetten (1989), the editor of "The Academy of Management Review" scientific journal, identifies the significant questions that each researcher should ask when judging whether a contribution is meaningful or not. These questions, which are interspersed within the theoretical, methodological and practical contributions sections of this chapter, are used to reflect on the contribution of this thesis.

8.3.1 Theoretical contribution

Theory and empirical findings contributions to this research are significant because they explicate the understanding of community development using ICT projects. The contribution is the response to the question about developing a framework, EA4CD, that integrates EA and CI to assist in implementing community-based ICT projects in rural and underserved communities.

Walsham (2017:34) makes a call that researchers "should welcome the various approaches and try to see whether they can be combined in a complementary way in interdisciplinary work." The IS discipline, by nature, receives contributions from anthropology, computer science, geography, and development studies (Ibid.).

This thesis makes a significant theoretical contribution to the current thinking by indulging in interdisciplinary work, integrating CI and EA to build an EA4CD framework to address the continuing neglect of rural and underserved communities. Also, the researcher's theoretical framework of PDT guided the research to

determine what will be measured. In this research, the Grabouw case led to the adoption of participatory design, which enabled government officials and community stakeholders to engage meaningfully, focusing on each other's experiences.

Further, the research's empirical findings suggest the need for Grabouw rural and underserved communities' meaningful participation in matters that involve their living.

The proposed EA4CD framework is dynamic, requiring constant evaluation, reviews, and updates to meet the growing challenges of the time. The proposed framework focuses on the range of complex or wicked problems such as social and cultural concerns affecting the rural and underserved communities. The EA4CD framework can affect how the government rolls out ICTs in rural and underserved communities. It can further influence how communities and community stakeholders select ICT projects relevant to their current needs. Participation is essential for responding to community needs. Significant interaction and communication between government officials, researchers, practitioners, and community stakeholders can solve these complex or wicked problems.

The systematic literature review has shown that even though rural communities lag in implementing ICT projects, there is still hope that the situation could be turned around. This research contributes to the hope to initiate an inclusive process that makes a difference in those living in rural villages and underserved communities.

South Africa is currently experiencing the triple challenge of unemployment, poverty, and inequality in a larger context, which excludes rural and underserved communities in participating in socio-economic activities. The proposed framework, EA4CD, is an attempt to address these concerns and find solutions to the triple challenge.

8.3.2 Methodological contribution

The way this research was undertaken is both new and innovative. For the first time, research in EA and CI has been undertaken using pragmatic design sciences principles, opening up new opportunities for researchers. The opportunity was manifested in the research design process, data collection and analysis, and the research design process appropriateness.

This research's primary methodological contribution was applying the fived phased DSR process and three DSR sub-cycle processes responding to the primary research questions and sub-research questions, respectively (section 5.11).

Although the literature extensively discussed the use of DSR, its application to the problem was innovative. The DSR methodology application within the social science setting explored the social interactions and systems processes to respond to the primary research question.

The next methodological contribution embedded in the application of DSR methodology is the experience gained in using an interpretive approach and data collection and analysis techniques used in the research. The use of interpretive research methods such as Braun and Clarke's six-phase reflexive thematic analysis process, Rahmani and Leifels' process of data analysis, and Rambaree' abductive grounded theory of data analysis to analyse SRQ 1, 2, and 3 provided an invaluable experience and contribution for future studies.

The conceptual framework application justified the use of theoretical concepts such as participatory theory developed in other contexts. The participatory development theory developed in other studies was confirmed as the critical theory in dealing with the digital divide.

In summary, this research contributes to the design knowledge by demonstrating the sequence of events leading to the design of the EA4CD framework artefact. Building and evaluating the artifacts contributed to a real-world problem with a real solution for real people. Design theory essentially explains how to "give an explicit prescription for constructing an artefact" (Gregor, 2006:620). Baskerville, Kaul, et al. (2018) argue that some degree of design theorising should be expected when designing an artefact in DSR. The 'building' of the new artefact is the first step towards contributing to designing knowledge. The methodical DSR approach explained earlier provided the rigorous process required in DSR. The advantage of this approach is the quality of improvement necessary to perfect the artefact.

8.3.3 Practical contribution

Does the thesis reflect seasoned thinking, conveying completeness and thoroughness?

The practical contribution attained through the empirical investigation undertaken by the researcher and described in this thesis, reflects the seasoned thinking of researchers such Hevner and Chatterjee (2010), Gregor (2010), Walls et al. (2012), Nunamaker et al. (2015) and many others who have contributed immensely to DSR as a paradigm. This research stands on the shoulders of the giants in an attempt to improve and implement community-based ICT projects for a better life for the communities. Throughout the research, DSR recognised five critical perspectives

defined in the Baskerville, Baiyere et al. (2018:11) paper. These perspectives are: (i) science and technology; (ii) design artefact; (iii) design theories; (iv) design processes; and (v) design impacts.

The DSR paradigm provides a place in the realm of science-technology dualism. The design of EA4CD framework as an ICT artefact, and the introduction of the artefact into the application domain, contributes to measurable improvements of the technology revolution, while the addition of the prescriptive knowledge in the form of the EA4CD framework contributes to nascent theories that will extend and generalise the knowledge contributions.

Baskerville, Baiyere et al. (2018:359) elucidate four crucial areas of DSR contribution: Firstly, the prescriptive technological knowledge where the artefact is new and its usefulness has just been demonstrated with limited conceptualisation and theorising. Secondly, design theory (prescriptive, scientific knowledge) is a desirable goal, as theorising around a class of artefacts progresses. However, these calls support the longitudinal goals of DSR for the continuous improvement of the application domain. Thirdly, the researcher's contribution lies in publishing research contributions as research continually evolves. Fourthly and finally, the relationship between descriptive knowledge obtained from kernel theories and the development of new artefacts demands considerable attention.

The design impact of the artefact, EA4CD has the potential to change and improve the livelihoods of a less fortunate and underserved community. ICT is one of the cardinal pillars that enables and supports socio-economic activities. Economic activities are changing from brick and mortar building to bits and bytes airwaves. Sections of communities who are not exposed to ICT activities will be deprived of the benefits that support human life and dignity.

The Grabouw case, which is mainly a farming area, demonstrates that the artefact, EA4CD, can have positive impact and effects in planning for socioeconomic activities that encourages social cohesion, which, in turn, can build the relevant social capital. It has a potential to equip citizens with right skills to enhance productivity; to inspire entrepreneurs; improve education and skill; and build good stewards who proudly lives and caring for their environment.

Numerous conferences debate the failures of ICTs in the developing world, resulting in the loss of vast amounts of money. For example, the DSR in Information Systems and Technology (DESRIST) has been conducting annual conferences since 2006. In the United States of America and in Australia, DSR scholars contributed much

towards creating interest in DSR. Winter's (2008) paper demonstrates the long roots of DSR in Europe. South African scholars took an interest in DSR. Scholars such as Professors van der Merwe, Kotze, De la Harpe, Gerber, Gilliland and many others embrace DSR in their scholarly activities. Both CI and EA have deep roots in South Africa. There is an Enterprise Architecture Collaboration Forum (EACF) in Pretoria run by Prof Alta van der Merwe. Several South Africans contribute knowledge towards the online CI forum and the *Journal of Community Information*.

The EA discipline is the subject of discussion at several conferences and workshops, as stated earlier. The power of the EA strategy is recognised and acknowledged, however, the general feeling among scholars is that it has not realised its full potential, especially in government circles. EA and CI integration excited the WCG high-ranking ICT officials. The TWK municipal councillors have a vested interest in the proliferation of ICT in this area. The community at large is watching this space with renewed hope, despite the researcher's counsel against raising community expectations.

8.4 Summary

In the penultimate chapter, the researcher presented DSR contributions by showing the salient points that have been gleaned from the empirical study. The findings against the research question have been revisited to affirm utility and validity. DSR contributions, comprising theoretical contributions, methodological contributions and practical contributions, were presented following Whetten's (1989) approach to judging scholarly contributions.

The theoretical contribution of this study encourages researchers to venture into a more interdisciplinary approach in order to harness the synergies of different disciplines. The use of the DSR approach to create new artefacts provides strengths within the knowledge base of design science.

The methodological contribution of this research lies in the scientific application of the phases of DSR and the sub-phases in the development of the EA4CD framework necessary to respond to the research questions.

The practical contributions of the study were possible because the community concerned itself with the experience or the usage of the DSR phases and sub-phases in order to find solutions to the research problems.

In the final chapter, the researcher presents his opinions of, and reflections on, the completed work.

CHAPTER NINE: REFLECTIONS AND CONCLUSION

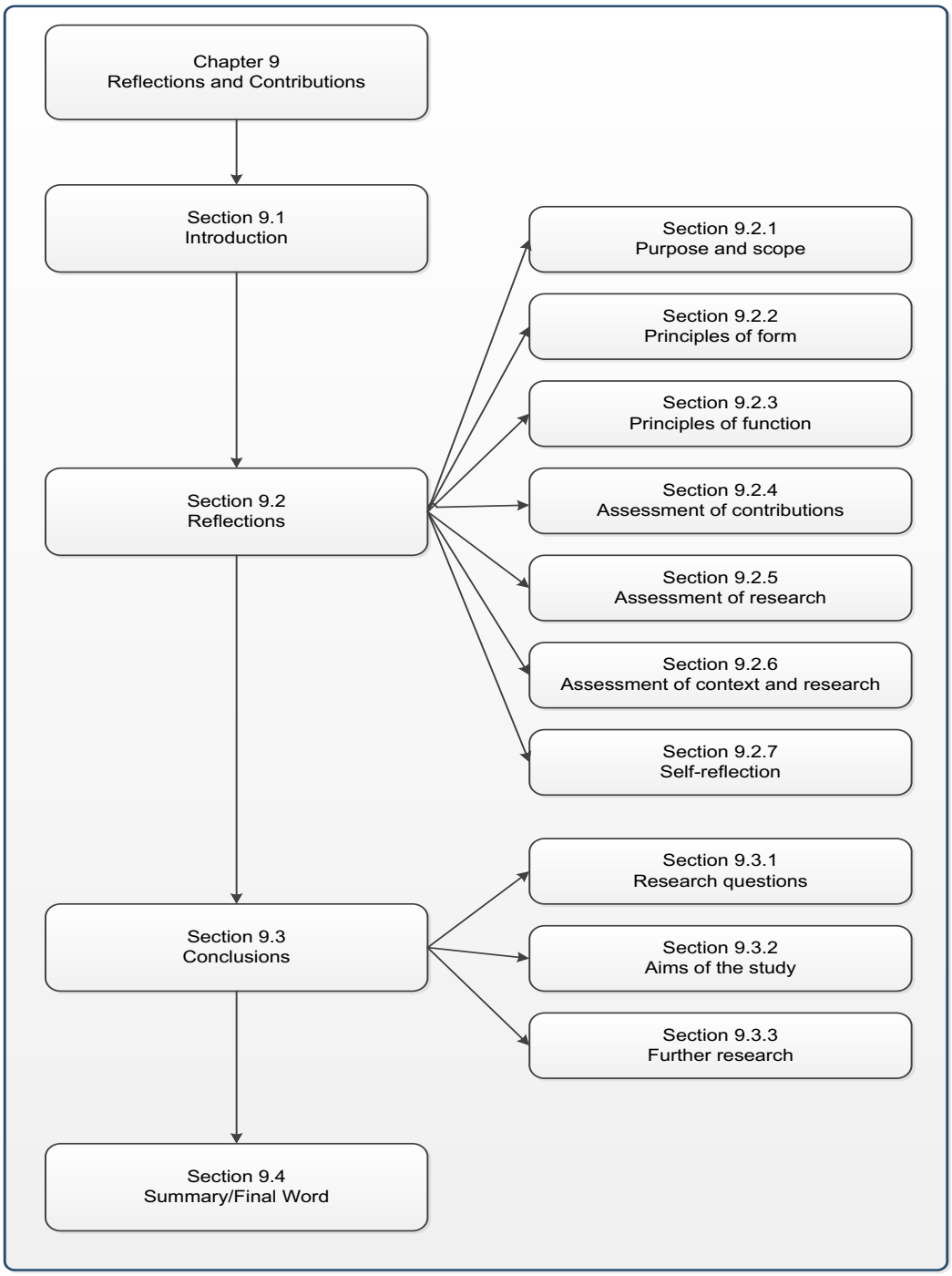

Figure 9.1: Chapter Nine flow

9.1 Introduction

In Chapter Eight, the researcher presented contributions of DSR to the research. In the final chapter, the researcher reflects on his experiences of the research (Figure 9.1). Gregor et al. (2013:9) presents a framework for extracting reflections of design theory research (Appendix K). The answers, provided by the reflective questions in the framework, offer the researcher's experiences of the study.

9.2 Reflections

9.2.1 Purpose and scope

What was the problem the researcher initially perceived?

Rural and underserved communities' need for a better life prompted curiosity in the researcher's mind. Service delivery protests are a common occurrence. Community members are struggling to find employment. Youth are dropping out of school. Crime is rampant. Innovative ICT is making headlines everywhere except in the rural and underserved communities.

Was the problem generated by the researcher or provided by someone else?

The researcher was part of the university's IT research team that partnered with the community to find ICT solutions to the socio-economic challenges faced by the community.

What is the goal of the artefact?

The goal of the EA4CD artefact is to bring about a harmonious relationship between government and the community stakeholders. Meaningful unity that transcends political affiliations should strengthen the synergies between the two groups.

How did the original design idea come about? Can you give the design idea a name?

The original idea came after reading Avgerou et al.'s (2016) editorial piece. They wrote the following: "Almost all governments in developing countries have ongoing information systems projects aiming at the efficiency of administration and improvement of public sector services" (Avgerou et al., 2016:31). The researcher thought it would be a good idea to integrate government and community efforts to implement mutually agreed solutions. In most cases, rural and underserved communities are the object of research, playing no part in their own development.

What concepts formed the basis for the first tentative design? From which fields did these concepts come? Why exactly these?

Interdisciplinary concepts of integration formed the basis for the first tentative design. The fields of CI and EA provided the basis for integration. CI specialises in the rural and underserved communities, while EA specialises in issues of governance and interoperability.

Were there subsequent problems that emerged? Did they require further innovative design ideas? What else was important?

The triple challenges of inequality, poverty and unemployment remain the problems that continually plague rural and underserved communities, despite efforts to

eradicate these challenges by 2030, as mentioned in Chapter One. The surprising fact is that these challenges continue to impact negatively on communities, despite the deployment and implementation of ICTs within these communities. Further innovative design ideas are required to allow the digital economy to touch the lives of people living in these communities. CI and EA are two disciplines that have the promise to advance the use of ICTs as tools and enablers. CI research outcomes need to reach more rural and underserved communities. EA strategies need more government attention in order to encourage more interoperability within government services. While ICTs abound in rural and underserved communities, information access, the slow pace of change and the cost of implementing ICTs remain a challenge.

9.2.2 Principles of form

What did material properties the designer deliberately build into the artefact to enable it to achieve its purpose?

The PDT as a theoretical lens was critical to the research because it ensured that all participants were involved in the building of the EA4CD framework.

What material properties of the artefact in use are observed to contribute to the emergence of the desired affordances?

EA and CI are the material properties that contributed to the design of the EA4CD artefact. The two IS disciplines contribute to interdisciplinarity integration, a necessary approach in engineering for a situation that integrates knowledge and methods.

What contextual conditions are observed to enable the emergence of the desired affordances?

The rural and underserved community provided the contextual environment for the new design artefact – the EA4CD framework.

Which user groups perceive which functional affordances of the artefact?

The citizens from the rural and underserved communities are the beneficiaries of the designed artefact. The benefits start from the planning phase and continue up to the implementation of the community-based ICT project. A crucial factor is that as the design artefact evolves, the community is not kept in the dark. Furthermore, the requisite skills that are necessary for community development are acquired, and thus, this contributes to the development of the local economy.

What changes are required in the essential material of the design artefact or the enabling contextual conditions to lead to the emergence of desired functional affordances?

More and more evaluations, both formative and summative, are required to identify issues that may have been overlooked. The evaluation solidifies an understanding and the use of ICT.

What justificatory knowledge provides support for the linking of the material properties to the achievement of the artefact's goals, as originally envisaged, or arising in use?

CI and EA have both acquired theoretical knowledge over a period, which has been applied successfully by government and business and within communities. However, the action has been undertaken in 'silos', fragmented at times, and does not inspire confidence in addressing the triple challenge South Africans face.

9.2.3 Principles of function

Which acts or interventions have to be performed in order to reach a specific goal?

The Grabouw community has a hub known as the Gerald Wright Thusong Service Centre where a basket of government services offered by the Department of Home Affairs (DoH), Department of Social Development (DSD), South Africa Social Security Agency (SASSA), Department of Labour (DoL), South African Police Services (SAPS) and Government Communication Information Services (GCIS) are provided. In the hub, regular stakeholder forum meetings are held where he miscellaneous issues that affect the community and small businesses are discussed. These meetings are organised under the auspices of TWK municipality officials in Grabouw.

Several community organisations are represented within this forum, and it is here that the municipality IT officials can attend to launch EA4CD framework.

Who is the agent?

TWK Municipality has two spheres of governance. The first sphere is the Council, which consists of elected political representatives. The second is the Administrative sphere with employees, bureaucrats executing the Council's decisions. TWK Municipality sustainability and TWK IT officials are better placed as agents of this initiative.

In what order should the actions be undertaken?

A TWK Council meeting should resolve to adopt the EA4CD framework. After that, a stakeholders' forum meeting should elect a representative committee that will deal with issues raised by the EA4CD framework.

What are the observed effects?

The researcher observed good attendance of the stakeholder forum meetings, even though some organisations do not attend the meetings. Representation is crucial and will need motivation to attract organisations that are not participating.

Which actions are necessary (or most necessary) to bring about desired outcomes? Why are these necessary? (Is there underlying support from justificatory knowledge?)

Participation is crucial in realising the goals for this research. It is through direct engagements that the real needs of the community are understood. Community participation encourages responsibility, commitment and sustainability regarding the ICT project as a community project, as opposed to a government project. When the community owns the project, it becomes easier to protect the ICT infrastructure.

Which actions are incidental to the outcome (where some other action could likely serve the purpose just as well)?

Enthusiasm and a *'never-give-up*' attitude are necessary to sustain the project. The Council's keen interest in the project could ensure its sustainability.

9.2.4 Assessment of contributions

In section 8.3, theoretical, methodological and practical IS DSR contributions are discussed. The theoretical contribution of this study is the integration of the CI and EA disciplines to improve the lives of people in rural and underserved communities. It is likely to impact on the interaction between communities and the government. The researcher received valuable experience in applying the main DSR cycle, with the sub-DSR cycles incorporated into it. Kotzé et al. (2015) argue that DSR, pitched at doctoral level, must have one DSR main cycle and two or more sub-cycles. The practical contributions are insights drawn when the EA4CD framework has been put to the test during the proof of concept, or the evaluation of the stages of the implementation of the EA4CD framework.

9.2.5 Assessment of the research

The research is crucial and critical to the rural and underserved communities. These communities are still trapped in a cycle of poverty, despite global initiatives to reduce poverty levels. The research responds as an enabler, transformer and driver

of the global SDGs and the South African National Development Plan (NDP), which promise to break the cycle of poverty by 2030, approximately 11 years away. The research sought to understand the challenges faced by the rural and underserved communities. The EA4CD framework encourages governments to plan *with* communities to ensure success in the implementation of community-based ICT projects.

9.2.6 Assessment of the context and research process

The researcher's choice of Grabouw provides a microcosmic context of the broader rural and underserved community landscape in South Africa. A significant number of rural and underserved communities in the country are neighbours to affluent communities and successful businesses. The social disparities of the rural and underserved communities are the reason for migrant labour moving from city to city seeking seasonal employment. The movement of labour often causes problems for small municipalities with respect to planning for spatial development and delivery of services, such as water, sanitation and electricity. Service delivery protests in South Africa, which are almost a daily occurrence, drive investors away from rural areas. Therefore, this research, presented in such a context, provides a participatory solution, which is an opportunity for all stakeholders to bring relief to the rural and underserved communities.

The nature of the problem sought a developmental paradigm that builds and evaluates the solutions. The DSR process, coupled with the abductive method of inquiry, was used. The researcher believed that the reasons for disparity in the lack of ICT usage are well documented in research. What was generally required was a process that responds to the 'how' question and, hence, the selection of the DSR process.

9.2.7 Self-reflection

The thought of doing a doctoral degree started in 2014 when I was invited to the Eastern University of Finland (UEF) as an exchange student. My aim was to register for the PhD degree at UEF. However, the Finnish language was a barrier. In 2015, I enrolled at the Cape Peninsula University of Technology (CPUT) for a doctoral degree.

I have lived in a deep rural community and in various underserved urban townships of South Africa, where the triple challenges of poverty, inequality and unemployment are rife. Schools, banks, health services and postal services are inaccessible in small towns, away from residential areas. ICT is touted as being able to bring viable

solutions to rural living. The proliferation of mobile technology in rural areas brought hope for a better future. However, the pace of change is painstakingly slow.

My background in education and training is immersed in Computer Science and Information Systems. A comparison of the disparities between the haves and have-nots bothered me. Well-documented ICT successes in big business and failures in developing rural communities led me to consider solutions rooted in ICT4D studies. CI studies motivated me to find reasons why it is so hard to change the status quo. John Zachman visited South Africa, where he presented the EA concept with passion and zeal. I ventured into EA, learning about its benefits and achievements. My interest was further stimulated when an opportunity to attend an EA workshop in Johannesburg, South Africa arose.

The niggling thought of the situation in rural and underserved communities never died. Three IS disciplines, EA, CI and ICT4D, were in my thoughts, which resulted in me sourcing papers and reading about the three disciplines. The rural context addressed by CI and ICT4D found a sympathetic ear within me. One Saturday evening after attending church, listening to the Pastor talking about the holistic approach to the gospel, which addresses the mental (education), the physical (health, manual labour and physical exercise) and the spiritual needs, I read Repko's (2001) thoughts on interdisciplinarity. The idea of integrating CI and EA to address the problems faced by rural and underserved communities grew. This thought seemed to lack focus, direction and depth. In January 2015, my supervisor and I discussed the idea. It seemed a plausible, researchable problem. However, two renowned EA professors could not see how these two divergent disciplines could be integrated. CI dealt with the community, while EA was mainly used to enhance business functions. On the other hand, other IS academics were excited by the thought of integrating CI and EA. They argued that this was what science required; breaking down the silo-mentality to solve problems affecting communities. One EA specialist explained that EA started in government military service, not in the business world. After long debates with myself, I decided to venture into integrating EA and CI in the rural and underserved communities.

In 2015, I was able to compile a research proposal, which the faculty's research committee approved. The Faculty of Informatics and Design (FID) at CPUT has other researchers working in Grabouw, Western Cape, so, it was not difficult to join the group. Ethics clearances (Appendices D and E) were secured, and the research journey started in earnest. However, as a lecturer at CPUT, I had a big university teaching load, which interfered with my studies. The death of my father in 2014, in

my rural community, was painful, and compounded the problem further. A successful proposal had been a mini victory, considering the unfortunate experiences at that time. As a novice researcher, this success boosted my resolve to convert the proposal into a successful thesis.

In 2016, the next task was to do an SLR on both EA and CI and to some extent, on ICT4D, responding to the research questions asked in the proposal. These disciplines were broad and extensive. Formulating an SLR was not a trivial exercise for a single novice doctoral student, but I accepted the challenge. In the process, I learnt how to use ATLAS.ti, a useful software tool to assist in data analysis. The year 2016 was an intensive and energy-sapping year, but thoughts of giving up were dispelled.

In April 2016, I was diagnosed with prostate cancer. The diagnosis was a massive blow to all the ambitions I had about life. Medical doctors initiated therapeutic sessions, which ended with a major operation in December 2016. Thank God, the cancer has been removed and in 2017, I was on the road to recovery. I was placed on six-month study leave, which allowed me to revive my doctoral studies.

In 2017, the SLR began to make sense and many lessons were learnt. The empirical study began with Grabouw as the focus. I attended a Grabouw community stakeholders' forum meeting, where interview appointments were arranged. Initially, I thought that it was going to be easy to secure interviews. Some community members felt that they were too insignificant to talk to a researcher. Other community members had been excited to speak to me about the problems they encounter and, at times, they expected me to provide solutions. The data collection period was often filled with desperation. There have been days when I would drive about 60 kilometres to meet an interviewee, only to be told within the 30 minutes of the interview that it had been cancelled. In such cases, I would hang around with friends in the informal settlement. On two or three occasions, I was able to interview young people on the streets while observing ethical principles. I felt like an ethnographer. The data collection experience taught me that neither people nor communities are homogeneous. Each of 33 interviews was unique and special.

The lesson I learnt was to transcribe interviews immediately and then start data analysis without waiting for the completion of the interviews. Transcriptions were a challenge, as initially, it took about 3 to 4 hours to transcribe a 45-minute interview. It was worth doing because, after transcribing, I was clear on the interviewee's response. Two or three times, I had to call the interviewees to confirm aspects of the interview.

In 2018, I began data analysis using ATLAS.ti. The data analysis was a challenge. Fortunately, during the data analysis period, I had a sense of coding and re-coding using ATLAS.ti. The process was complicated and there were times when I felt that the data analysis was a futile exercise. However, with severe scrutiny and abductive inferential reasoning, themes began to emerge. DSR phases assisted in 'building' a design artefact. Towards the end of 2018, a picture started to emerge and I began to portray that picture in writing. I experienced the same 'lonely PhD journey' that those who have walked before had experienced. The nights were long and frustrating. Writing a thesis is not a leisurely walk in the park.

In 2019, the research process continued, with the writing of the thesis. In May 2019, saw the first draft of the thesis and in June and July 2019, the process of refining and refining continued. I have learnt many valuable lessons in thesis formulation and writing, which I will take forward to assist new researchers.

9.3 Conclusions

The research concludes by revisiting the research questions, the aim of the study and by stating overall general comments about this research.

9.3.1 Research questions answered

The **research questions** (section 1.5) that guided the SLR were:

PRQ: How can Enterprise Architecture for Community Development (EA4CD) framework be developed to integrate EA, CI and community needs to assist with the implementation of community-based ICT projects in rural and underserved communities?

Comments

The research question was critical in that it highlighted the responsibility for creating a framework as a design artefact, integrating CI and EA, thus providing a platform from which to launch implementation of community-based ICT projects. EA is a well-established and highly technical discipline that promises an holistic approach in IT and business. CI has been actively involved in improving the use of ICT in communities. Governments have used EA as a solution to integrate government processes. The designed EA4CD framework is intended to draw from the proper tenets of EA and CI, addressing the persistent and unique challenges of rural and underserved communities.

SRQ 1: Why are rural and underserved communities not benefiting from CI when implementing community-based ICT projects?

Comments

ICT is advancing with the ushering in of the 4IR. While ICT advances are exponential, rural and underserved communities are advancing at a slower pace. National, provincial and local government needs to improve their strategies, giving more consideration to contextual problems experienced in rural and underserved communities. The researcher felt that more could be done for rural and underserved communities. Government officials should involve the communities in planning and decision-making. Civil and political instability divides the communities in respect to their priorities regarding improving the lives of ordinary citizens. The ordinary citizens find it an untenable situation that crime, lack of unemployment, lack of education and skills, and a lack of many other social problems, are allowed to persist.

SRQ 2: What is the role of government EA in implementing community-based ICT projects?

Comments

The government will always play a role in the development of people. The government is chosen by the people and is mandated to work for the people. EA in government is critical in assisting rural and underserved communities by providing these communities with the tools necessary to assist them to be independent. For example, the government can assist communities by building ICT infrastructure that will encourage the communities to implement community-based ICT projects.

SRQ 3: How can EA and CI be integrated to address community needs in the rural and underserved communities?

Comments

EA and CI can be integrated by allowing more community and government participation. Participation can encourage people to take an interest in developing their lives. It alludes to the fact that EA and CI are critical disciplines in advancing the ambitions of the rural and underserved communities.

9.3.2 Aim of the study

In this study, the researcher aimed to explore how EA and CI can be integrated in rural and underserved communities. Reflecting on the research process of this study, the aim of the study was fulfilled once the EA4CD framework was defined.

The communities expressed their ICT wishes, thereby enabling the implementation of community-based ICT projects that can enhance the living conditions. It is envisaged that enhanced livelihoods of members of the rural and underserved communities will reduce the much talked-about gap between the haves and the have-nots.

9.3.3 General

This research does not provide a single solution to all the current problems, relating to the provision of ICT projects in rural and underserved communities. This research was exploratory and ground breaking. More research is required to observe, explain and analyse the implementation of the observed reactions.

9.3.4 Limitations and further research

The research has potential limitations. DSR methodology, access and analysis of data are highlighted as potential limitations. Baskerville, Baiyere et al. (2018:369) argue that DSR projects are "typically longitudinal streams of research". DSR requires varied contributions at different points along the research stream. A more descriptive knowledge, explanatory studies, and the developmental knowledge of the new artefacts demand considerable attention in DSR (Ibid.).

In the SLR chapter the researcher found that there was dearth of literature on the integration of CI and EA disciplines. To mitigate this limiting factor, the study's aim is explorative in nature. This means that the findings in this research are subject to descriptive research, expanding the understanding of the phenomenon. In this research EA4CD artefact need further rigorous study and evaluation to further understand the extent of the impact to the community.

The next limitation is on collection and analysis of data. Interviews and a focus group were used to collect data. …

The subject requires further research that builds on the EA4CD framework. The framework needs testing and verification. It further needs an analysis of the implementation of community-based ICT projects in order to test the veracity of the framework.

9.4 Summary / final word

The outcome of this study is refreshing and exciting. It is encouraging to see that there can be some good coming out of the integration of a variety of disciplines. Proceeding from here, the researcher believes a single step forward has been achieved. Progress has been realised, which adds to the current body of knowledge.

This thesis contributes to the body of knowledge of the EA, CI and ICT4D disciplines.

> "I do not know what I may appear to the world; but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me" – Isaac Newton.

"*Through faith, we understand*" – Hebrews 11:3.

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APPENDIX A: THE 138 REVIEWED ARTICLES

#	Author(s)	Year	Type	Title
1	Adomah-Afari	2015	Journal	The contribution of community leadership upon the performance of mutual health organisations in Ghana
2	Aier	2011	Conference	Understanding enterprise architecture management design - An empirical analysis
3	Aier	2014	Journal	The role of organisational culture for grounding, management, guidance and effectiveness of enterprise architecture principles
4	Al-Nasrawi and Ibrahim	2013	Conference	An enterprise architecture mapping approach for realising e-government
5	Alwadain et al.	2016	Journal	Empirical insights into the development of a service-oriented enterprise architecture
6	Anthopoulos	2009	Journal	Applying enterprise architecture for crisis management – A case of Hellenic Ministry of Foreign Affairs (MFA)
7	Anthopoulos	2012	Journal	An investigative assessment of the role of enterprise architecture in realising e-government transformation
8	Arnold and Stillman	2013	Journal	Power, communities, and community informatics: A meta-study
9	Ashraf et al.	2015	Journal	Impact of ICT usage on indigenous peoples' quality of life
10	Attwood et al.	2013	Journal	Telecentre functionality in South Africa: Re-enabling the community ICT access environment
11	Avgerou	2008	Journal	Information system in developing countries: A critical research review
12	Avgerou et al.	2016	Journal	Growth in ICT uptake in developing countries: New users, new uses, new challenges
13	Bailey and Ngwenyama	2011	Journal	The challenge of e-participation in the digital city: Exploring generational influences among community telecentre users
14	Bailey and Ngwenyama	2016	Journal	Community bridging through ICTs: Seeking to overcome digital and community divides
15	Bakar et al.	2016	Journal	Assessment of enterprise architecture implementation capability and priority in public sector agency
16	Banaeianjahromi & Smolander	2016	Journal	What do we know about the role of enterprise
17	Bernus et al.	2016	Journal	Enterprise engineering and management at the crossroads
18	Bernus et al.	2014	Conference	Enterprise architecture: Twenty years of the GERAM Framework
19	Bischoff et al.	2014	Conference	Use it or lose it? The role of pressure for use and utility of enterprise architecture artefacts
20	Boh & Yellin	2006	Journal	Using enterprise architecture standards in managing information technology
21	Box & Lemon	2015	Journal	The role of social architecture in information infrastructure: A report for national environmental information infrastructure (NEII)
22	Buckl et al.	2007	Conference	A pattern-based approach for constructing enterprise architecture management information models
23	Buckl et al.	2009	Conference	A viable system perspective on enterprise architecture management

#	Author(s)	Year	Type	Title
24	Bytheway et al.	2015	Journal	Introduction: Research methods for community informatics
25	Carroll & Rosson	2010	Journal	Design Studies
26	Chowdary	2002	Journal	Information technology for development: necessary conditions
27	Cohen et al.	2002	Journal	Information and Communications Technology (ICT) and transport: Does knowledge underpin policy?
28	Corey and Wilson	2009	Journal	E-business and E-Commerce Management
29	Dale and Scheepers	2019	Journal	Enterprise architecture implementation as interpersonal connection: Building support and commitment
30	Davis et al.	2014	Journal	Advancing socio-technical systems thinking: A call to bravery
31	Day	2010	Journal	A brief introduction to the history of community informatics
32	De Araujo & Reinhard	2013	Journal	Factors influencing the use of electronic government services in Brazil
33	Dearden & Kleine	2019	Conference	Ethical standards for the ICTD/ICT4D community: A participatory process and a co-created document
34	Delport et al.	2016	Conference	Towards corporate governance of ICT in local government
35	United Nations.	2016	Report	United Nations e-Government survey. Department of Economics and Social Affairs
36	Donner et al.	2008	Journal	Stages of design in technology for global development
37	Du	2011	Conference	Enhancing social inclusion of rural libraries: A community outreach approach
38	Dwivedi et al.	2014	Journal	Research on information systems failures and successes: Status update and future directions
39	Fallmyr and Bygstad	2014	Conference	Enterprise architecture practice and organisational agility: An exploratory study
40	Fischer et al.	2007	Journal	A federated approach to enterprise architecture model maintenance
41	Gush & De Villiers	2010	Journal	Application usage of unsupervised digital doorway computer kiosks in remote locations in South Africa
42	Goodwin	2007	Journal	Community informatics and the local state in the UK: Facilitating or assimilating an agenda for change?
43	Goodwin	2012	Journal	Theorising community as discourse in community informatics: “Resistant Identities” and contested technologies
44	Gregor et al.	2007	Journal	Enterprise architectures: Enablers of business strategy and IS/IT alignment in government
45	Guijarro	2007	Journal	Interoperability frameworks and enterprise architectures in e-government initiatives in Europe and the United States
46	Guo et al.	2007	Journal	Very low-cost internet access using KioskNet
47	Gurstein	2000	Journal	Community informatics: enabling uses of information and communication technology
48	Gurstein	2003	Journal	Effective use: A community informatics strategy beyond the digital divide
49	Gurstein	2004	Journal	Welcome to the Journal of Community Informatics
50	Gurstein	2007	Journal	What is community informatics and why does it matter?

#	Author(s)	Year	Type	Title
51	Hagar	2008		The convergence of community informatics and library and information science: the impact for library users
52	Haigh	2011	Journal	The history of information technology
53	Haki et al.	2012	Conference	Beyond EA frameworks: Towards an understanding of the adoption of enterprise architecture management
54	Halawi et al.	2019	Journal	Where we are with enterprise architecture
55	Hameed	2007	Journal	ICT as an enabler of socio-economic development
56	Han	2016	Conference (Doctoral Colloquium)	Studying the application of mobile technology to local communities
57	Harris	2002	Book	Information and communication technologies for rural development in developing countries: Methodologies for systems design and evaluation
58	Harris	2015	Journal	How ICT4D research fails the poor
59	Hayes & Westrup	2012	Journal	Context and the processes of ICT for development
60	Heeks	2008	Journal	ICT4D 2.0: The next phase of applying ICT for international development
61	Heeks	2012	Journal	ICTs and gross national happiness
62	Heeks	2006	Journal	Health information systems: Failure, success and improvisation
63	Heeks & Molla	2009	Working paper	Impact assessment of ICT-for-Development projects: A compendium of approaches
64	Hiekkanen et al.	2013	Journal	Architect's perceptions on EA use - An empirical study
65	Hilbert	2012	Journal	Towards a conceptual framework for ICT development
66	Hirschheim and Klein	2010	Journal	A short and glorious history of the information systems filed
67	Hjort-Madsen	2007	Journal	Institutional patterns of enterprise architecture adoption in government
68	Hjort-Madsen and Pries-Heje	2009	Conference	Enterprise architecture in government: Fad or future?
69	Iyamu	2009	Conference	Factors affecting institutionalisation of enterprise architecture in the organisation
70	Iyamu	2011	Conference	Enterprise architecture as information technology strategy
71	James	2001	Journal	Towards a better understanding of the ICT sector in South Africa: Problems and opportunities for strengthening the existing knowledge base
72	Janssen et al.	2013	Journal	Government architecture: Concepts, use and impact
73	Jere et al.	2013	Conference	An assessment of ICT challenges in rural areas: ICT experts vs. rural users views: A Case of the Siyakhula Living Lab
74	Jinqiu	2004	Journal	Cyber communities in rural China
75	Jonkers et al.	2006	Journal	Enterprise architecture management tool and blueprint for the organisation
76	Kamogawa & Okada	2005	Journal	A framework for enterprise architecture effectiveness
77	Kandjani et al.	2013	Conference	Enterprise architecture cybernetics and the edge of chaos: Sustaining enterprises as complex systems in complex business environments
78	Kaushik & Raman	2015	Journal	The new data-driven enterprise architecture for e-healthcare: Lessons from the Indian public sector

#	Author(s)	Year	Type	Title
79	Kenny	2000	Journal	Expanding Internet access to the rural poor in Africa
80	Kivunike et al.	2011	Journal	Perceptions of the role of ICT on quality of life in rural communities in Uganda
81	Kleine	2015	Journal	ICT4D
82	Kloeckner & Birkmeier	2010	Journal	Something is missing: Enterprise architecture from a systems theory perspective
83	Korhonen & Poutanen	2013	Journal	Tripartite approach to enterprise architecture
84	Kotusev	2016	Journal	Enterprise architecture frameworks: The fad of the century
85	Kotusev	2017	Journal	Eight essential enterprise architecture artefacts
86	Kramer et al.	2007	Journal	The role of the information and communications technology sector in expanding economic opportunity
87	Krauss	2013	Journal	The collision between the worldviews of international ICT policy-makers and deep rural community in South Africa: Assumptions, interpretation, implementation and reality
88	Kumar	2012	Journal	'Rural Informatics': Use of information and communication technologies for the rural poor – from digital divide to digital opportunity in rural India
89	Kummamuru	2012	Journal	Cybernetics framework for addressing the people-related challenges in an IT services organisation
90	Lagerström et al.	2011	Journal	Enterprise architecture management's impact on information technology success
91	Lange & Mendling	2011	Conference	An expert perspective on enterprise architecture goals, framework adoption and benefit assessment
92	Lange et al.	2012	Conference	A comprehensive EA benefit realisation model – An exploratory study
93	Lapalme	2012	Journal	Three schools of thought on EA
94	Lapalme et al.	2016	Journal	Exploring the future of enterprise architecture: A Zachman perspective
95	Le Roux	2010	Journal	Exploring the future of enterprise architecture: A Zachman perspective
96	Leye	2009	Journal	Information and communication technologies for development: A critical perspective
97	Magoulas et al.	2012	Journal	Alignment in enterprise architecture: A comparative analysis of four architectural approaches
98	Mamba & Isabirye	2015	journal	A framework to guide development through ICTs in rural areas in South Africa
99	Matthee & Van der Merwe	2007	Journal	The status quo of enterprise architecture implementation in South Africa financial services companies
100	McDonald	2016	Journal	ENCITE: A model to help voluntary organisations use ICT effectively
101	McDougall & Jones	2006	Journal	Theory and history, questions and methodology: current and future issues in research into ICT in education
102	McIver	2003	Journal	A community informatics for the information society
103	Munro	2000	Journal	Exploring and explaining the past: ICT and history
104	Pade-Khene et al.	2011	Journal	Sustainable rural ICT project management practice for delivering countries: Investigating the Dwesaand RUMEP projects

#	Author(s)	Year	Type	Title
105	Panetto et al.	2016	Journal	New perspectives for the future interoperable enterprise systems
106	Parker et al.	2013	Journal	RLabs A South African perspective on a community-driven approach to community information
107	Pereira & Sousa	2004	Journal	A method to define an enterprise architecture using the Zachman framework
108	Pratschke	2007	Journal	Architecture as a verb: Cybernetics and design processes for the social divide
109	Proper et al.	2018	Conference	Enterprise architecture modeling
110	Puri & Sahay	2007	Journal	Role of ICTs in participation development: An Indian experience
111	Raiti	2007	Journal	The lost sheep of ICT4D research
112	Rojko et al.	2011	Journal	Information communication technology spending in 2008 economic crisis
113	Romero & Vernadat	2016	Journal	Computers in industry enterprise information systems state of the art: Past, present and future trends
114	Rothenbergy-Aalami & Pal	20056	Journal	Rural telecentre impact assessments and the political economy of ICT for development (ICT4D)
115	Saad-Sulonen	2010	Journal	The value of community informatics to participatory urban planning and design: A case-study in Helsinki
116	Šaša and Krisper	2011	Journal	Enterprise architecture patterns for business process support analysis
117	Schneider et al.	2013	Conference	Goals in enterprise architecture management – Findings from literature and future research directions
118	Schwab	2015	Journal	The fourth industrial revolution
119	Schwab	2016	Book	The fourth industrial revolution
120	Sewchurran & Sewchurran	2011	Journal	Exploring developmental and community informatics
121	Shanks et al.	2018	Journal	Achieving benefits with enterprise architecture
122	Songan et al.	2004	Book chapter	Community informatics: Challenges in bridging the digital divide
123	Sowa & Zachman	1992	Journal	Extending and formalising the framework for information systems architecture
124	Stillman and Linger	2009	Journal	Community informatics and information systems: Can they be better connected?
125	Stoecker	2005	Journal	Is community informatics good for communities? Questions confronting an emerging field
126	Tang et al.	2004	Conference	A comparative analysis of architecture frameworks
127	Twum-Darko	2014	Journal	Sustainable local economic development: The role of informatics in determining municipal revenue management
128	Uys & Pather	2016	Journal	Government Public Access Centres (PACs): A beacon of hope for marginalised communities
129	Valtonen et al.	2010	Conference	EA as a tool in change and coherency management - a case of a local government
130	Van den Berg et al.	2019	Journal	How enterprise architecture improves the quality of IT investment decisions
131	Van Dijk et al.	2013	Journal	Building an effective enterprise architecture capability
132	Walsham	2012	Journal	Are we making a better world with ICTs? Reflections on a future agenda for the IS field

#	Author(s)	Year	Type	Title
133	Walsham	2017	Journal	ICT4D research: Reflections on a future agenda for the IS field
134	Weerakkody et al.	2007	Book chapter	Integration and enterprise architecture challenges in e-Government: A European perspective
135	Whitman et al.	2001	Book chapter	A taxonomy model of the enterprise
136	Williams and Durrance	2009	Book chapter	Community informatics
137	Zachman	1997	Journal	Concepts of the framework for enterprise architecture
138	Zachman	1997	Journal	Enterprise architecture: The issue of the century

APPENDIX B: INTRODUCTORY LETTER

Cape Peninsula
University of Technology

Introductory letter for the collection of research data

David John Mzwandile Makola is registered for the D Tech (IT) degree at CPUT (202086992). The thesis is titled "An integration of community informatics and enterprise architecture in ICT projects: Grabouw case study in South Africa", and aims of this study is to explore and explain the challenges facing rural poor and under developed communities when adopting ICT within their rural communities. A further aim is to propose a theory on how community informatics and enterprise architecture can be integrated/linked in order to build a framework (or a strategy/model) for the implementation, and maintenance of ICT infrastructure in rural poor and under developed communities. This research will seek to propose a strategy or model for addressing the research problem. This pragmatic, yet supportive approach will be useful in considering the objective needs of the rural poor and under developed communities.

The supervisor(s) for this research is:

Dr. AC de la Harpe (email: *delaharpeA@cput.ac.za;* mobile: 0214603627).

In order to meet the requirements of the university's Higher Degrees Committee (HDC) the student must get consent to collect data from organisations which they have identified as potential sources of data. In this case the student will use purposive and snowballing sampling techniques to gather data.

If you agree to this, you are requested to complete the attached form (an electronic version will be made available to you if you so desire) and print it on your organisation's letterhead.

For further clarification on this matter please contact either the supervisor(s) identified above, or the Faculty Research Ethics Committee secretary (Ms V Naidoo) at 021 469 1012 or naidoove@cput.ac.za.

Yours sincerely

Dr AC de la Harpe

03 November 2015

APPENDIX C: EXAMPLE OF AN INDIVIDUAL CONSENT FORM

FID/REC/ICv0.1

FACULTY OF INFORMATICS AND DESIGN

Individual Consent for Research Participation

Title of the study: *An integration of community informatics and enterprise architecture in ICT projects for rural communities: A case in Grabouw, Western Cape, South Africa.*

Name of researcher: David Makola
Contact details:email: makolad@cput.ac.za phone: **0836776600**

Name of supervisor: Dr. AC de la Harpe
Contact details:email: delaharpea@cput.ac.za phone: **0824481058**

Definition of terms:

Community Informatics *is an interdisciplinary field that is concerned with using information and communication technology (ICT) to empower members of communities and support their social, cultural, and economic development.*
Enterprise Architecture *is the process of modelling all aspects of the organisation (i.e. the enterprise) to ensure that services, processes, applications, information, data, technology, locations, people, events and timelines are all aligned with the enterprise goals and objectives to execute effectively a business plan.*
ICT *stands for* ***information and communication technologies*** *and are defined as a diverse set of technological tools, e.g. cellphones, laptops, tablets etc. and resources used to communicate, and to create, disseminate, store, and manage information.*

Purpose of the Study:

- *To integrate CI and EA strategies in implementing ICT projects within the poor rural and underserved communities in South Africa.*
- *To determine the challenges faced by the poor rural and undeserved communities when implementing ICT projects. This will be done by understanding the internal and external factors that affect the implementation of ICT in the poor rural and undeserved communities.*
- *To establish a framework where CI and EA strategies can assist in the implementation of ICT projects in the poor rural and undeserved communities.*

Participation: My participation will consist essentially of Interviews, Questionnaires, and Focus Groups.

APPENDIX D: DATA COLLECTION PERMISSION LETTER

ELGIN
Learning Foundation

TO WHOM IT MAY CONCERN.

I , Veronica Jacobs, in my capacity as Divisional Manager, Corporate Services, Fundraising and Client Relationships at the Elgin Learning Foundation , give consent, in principle, allowing Mr. David Makola, a student at the Cape Peninsula University of Technology, to collect data in this organisation as part of his/her M Tech (IT) research. The student has explained the nature of his/her research and the nature of the data to be collected to me.

This permission in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants he wants to involve in the research.

I reserve the right to withdraw this permission at some future time.

In addition, the organisation's name may or may not be used as indicated below.

Permission to use the organisation's name in any way will only be given once the author of this letter has had the opportunity to view the publication as indicated below.

	Thesis	Conference paper	Journal article	Research poster
Yes	√	√	√	√
No				

Veronica Jacobs

Veronica Jacobs

22 September 2015

Tel: (021) 848 9413 Fax: (021) 848 9414 - www.elginlearning.org.za - P.O Box 654, Grabouw, 7160 - 9 Appletiser Road, Elgin, 7180
Trust Nr: T4233/94, NPO Nr: 025-491-NPO

APPENDIX E: E-MAIL CORRESPONDENCE: PERMISSION TO CONDUCT RESEARCH

From: Hilton R Arendse
Sent: Monday, April 23, 2018 1:30 PM
To: David Makola <MakolaD@cput.ac.za>
Subject: RE: Permission to conduct interviews for doctoral studies

Hi David

Unfortunately, the mail below did not go through yesterday.

I am thus sending you two mails with an attachment each.

Kind regards,

H.

From: Hilton R Arendse
Sent: Monday, April 23, 2018 1:30 PM
To: David Makola <MakolaD@cput.ac.za>
Subject: RE: Permission to conduct interviews for doctoral studies

Hi David

Attached please find the documents as promised.

All the best with your thesis.

Kind regards,

H.

From: David Makola [mailto:MakolaD@cput.ac.za]
Sent: Thursday, March 8, 2018 9:55 AM
To: Hilton R Arendse <Hilton.Arendse@westerncape.gov.za>
Subject: RE: Permission to conduct interviews for doctoral studies

Morning Mr Arendse,

Thanks for reverting back to me.

I say yes to the 26 March 2018. You can also choose the time so that we can diarise.

Warm regards and best wishes in your job.

David Makola
Lecturer - Department of Information Technology
Room 2.45 - ICT Building, Cape Town Campus
Faculty of Informatics and Design
Cape Peninsula University of Technology
PO Box 652
Cape Town, South Africa

APPENDIX F: ETHICS CERTIFICATE

Cape Peninsula
University of Technology

P.O. Box 652 • Cape Town 8000 South Africa •Tel: +27 21 469 1012 • Fax +27 21 469 1002
80 Roeland Street, Vredehoek, Cape Town 8001

Office of the Research Ethics Committee	Faculty of Informatics and Design

Ethics approval was granted to MR DAVID MAKOLA, student number 202086992, on

29 April 2015 for research activities related to the DTech: Information Technology degree

at the Faculty of Informatics and Design, Cape Peninsula University of Technology.

Title of dissertation/thesis:	An integration of community informatics and enterprise architecture in ICT projects for rural communities: A case of Grabouw, Western Cape, South Africa

Comments

Research activities are restricted to those data led in the research process.

Signed: Faculty Research Ethics Committee	Date 29/4/2015

RESEARCH ETHICS COMMITTEE
INFORMATICS AND DESIGN
ETHICS APPROVAL GRANTED
29 APR 2015
Cape Peninsula
University of Technology

APPENDIX G: INTERVIEW GUIDE

Interview plan for Grabouw:

1. Community
    a. Local citizens
    b. Ward/Councillors
    c. Church leaders
        i. Pastor
        ii. Members of the church
2. Schools
    a. Township school
    b. Farm school
    c. Model C school
3. Clinics
    a. Sister in charge
    b. Nurse
4. Police station
    a. Station commander
    b. Police
5. Business
    a. Small business - Entrepreneurs (2 or 3)
    b. Big business - Farm owners
6. Access centre
    a. Man in charge
    b. Members of the centre

Interview Guide (for Individuals and focus groups)

An integration of community informatics and enterprise architecture in ICT projects for rural communities: A case in Grabouw (Theewaterskloof municipality), Western Cape, South Africa

Introduction

Good morning/afternoon/evening, I'm David Makola (202086992), a Doctoral student at CPUT under the supervision of Dr AC de la Harpe. The thesis is titled "An integration of community informatics and enterprise architecture in ICT projects for rural communities: A case in Grabouw (Theewaterskloof municipality), Western Cape, South Africa".

The rapid growth and proliferation of ICT projects and investments are transforming the world. Organisations, companies, businesses and governments are adapting to these changes, changing the way of doing business. Both Community Informatics (CI) and Enterprise Architecture (EA) are currently used in implementing community and organisation ICT projects.

***CI** is a discipline that focuses on the application of Information and Communications Technologies (ICTs) to enable and empower community processes. While **EA** is the process of modeling all aspects of the organisation (i.e. the enterprise) to ensure that services, processes, applications, information, data, technology, locations, people, events and timelines are all aligned with the enterprise goals and objectives to execute a business plan effectively.*

While CI and EA promise great rewards in implementing ICT projects, rural and underserved communities have unique challenges when considering ICT strategies that could benefit them. As a result, these communities are not benefiting from the available ICT infrastructures.

It is the aim of this study to explore and explain the challenges facing rural poor and underserved communities when adopting ICT within their rural communities. A further aim is to propose a theory on how community informatics and enterprise architecture can be integrated to build a framework for the implementation and maintenance of ICT infrastructure in rural poor and underserved communities.

Your responses are invaluable, and we respect and appreciate the time given to us; this would not take more than _____. This interview will be recorded. If you have any objections, please let me know. If you have any questions or doubts, do not hesitate to ask me at any time. Shall we begin?

Interview Questions

Professionals (CIOs, IT Directors, IT Managers in the Western Cape Province or Overberg/ Theewaterskloof Municipality)

Research Question 1

1. What is your name?

   _____

2. What is your position in the Provincial Department of Health (DoH)?
   Briefly explain your responsibilities in your position.
   How long have you been in your position?

3. What is the current state of ICT infrastructure within the remote rural areas and underserved communities of the Western Cape?

4. What is the role of ICT strategies in sustaining the millennium developmental goals; such as alleviation of poverty and hunger, achieving universal primary education, gender equality and empowering of women, reduction of child mortality, improvement of maternal health, combating of HIV/AIDS, TB and other dreaded diseases, and ensuring environmental sustainability within the Western Cape?

5. Are rural and the poor communities aware of ICT strategies that can bring in a better life?

6. What ICT strategies directly address the sustainable developments within the rural and poor communities in the Western Cape, in the Overberg district, in Theewaterskloof municipality and Grabouw?

7. What are the internal factors within the department that affect the implementation of ICT strategies in rural poor and underserved communities in Theewaterskloof municipality and in Grabouw?

8. What are the external factors outside the department that affect the implementation of ICT strategies in rural poor and underserved communities in Theewaterskloof municipality and in Grabouw?

9. What is the Internet usage within the rural poor and underserved communities of the Western Cape? Of the Overberg district? And of Theewaterskloof municipality? And of Grabouw?

10. What is the mobile technology usage in rural poor and underserved communities of the Western Cape? Of the Overberg district? And of Theewaterskloof municipality? And of Grabouw?

11. What challenges do rural poor and underserved communities face when ICT strategies are implemented in their communities?

12. What future plans are there to build a sustainable ICT infrastructure?

Research Question 2

13. What are the basic needs of the rural poor and underserved communities within the Theewaterskloof municipality?

14. Are these needs different from other municipalities within Overberg/Theewaterskloof?

15. What measures have you taken to identify what the rural poor and underserved community's needs are?

16. Which of the following purposes summarise the need for Community Informatics?
    - To build up communities
    - To develop information
    - To provide access to technology
    - All of the above
    - None of the above

17. How do you empower communities through ICTs in rural poor and underserved communities?

18. How do you raise funding to build ICT sustainable infrastructure in the rural poor and underserved developed communities?

19. What strategies do you use to deal with differences in languages within the same community?

20. How do you coordinate the human resources within the rural poor and underserved communities to deliver an ICT project that will be understood by the majority of the community?

21. How do you model the different aspects of the organisation to ensure that services, processes, applications, information, data, technology, locations, people, events and timelines are all aligned with the department goals and objectives to execute an integrated business plan effectively in the rural poor and underserved communities?

22. How are EA strategies linked to communities living in rural and underserved areas?

23. What EA approaches are implemented to reach the remote rural areas of this province?

24. What EA approaches are implemented to reach the underserved communities?

25. How do/can you integrate CI needs and EA strategies to meet the needs of the rural and underserved developed communities?

<u>Community</u> (Community leader, member of community, Councillor, Teacher or Nurse, Community worker)

Research Question 1

1. What is your name?
   _____

2. What is the name of your organisation?
   _____

3. What is your role in the (NGO) community?

4. How long have been living (or serving) in this community?

5. What is the current state of ICT infrastructure available within the community?

6. What is the Internet usage within these communities?

7. How do you access the Internet?
    - At home?
    - At school?
    - At the church?
    - Or in the library
    - or in the Internet café
    - Or other?

8. Why do you need access to the Internet?

9. In your opinion, do you think that a majority of this community own cell phones?

10. For what purpose do you use your cell phone?

11. How can you use the cell phone, and/or laptops and/or computers to address the millennium developmental goals such as alleviation of poverty and hunger, achieving universal primary education, gender equality and empowering of women, reduction of child mortality, improvement of maternal health, combating of HIV/AIDS, TB and other dreaded diseases, and ensuring environmental sustainability within this community?

12. What challenges do you face that hinder the use of ICTs to address the sustainability developments within these communities?

13. What can the community do to provide the basic ICT infrastructure to access information and compete in global markets?

14. What must the government/province do to provide ICT infrastructure within the community?

15. What challenges will the rural poor and underserved communities face when ICT strategies are implemented in their communities?

16. How can the community preserve the ICT infrastructure?

Research Question 2

17. What are your basic needs to maintain the cost of living?

18. Are your basic needs similar to that of the community? Explain.

19. What is your opinion about the sharing of resources, such as the library, clinics, stadia, etc., as a community?

20. How can ICT be used to develop the community?

21. How must issues of access and participation in communal activities using ICT be addressed?

22. How can the poorest of the poor be encouraged to engage meaningfully with ICT-based projects?

23. How can issues of language be addressed?

24. How can issues of security be adequately addressed within the community?

25. What can be done to integrate government services using ICT?

APPENDIX H: ATLAS.ti REPORTS

EA4CD Theory Matching Steps

Step 1

Initial Codes (Open Coding)	Potential Theoretical Areas	Key Literature
Crime Alcohol and drug abuse Education and skills sample - Description: Poverty Housing Land Resources Mobile/migrant workers	Critical Social Theory	Bailey and Ngwenyama (2016)
	Bourdieu's Theory of Practice (*How social beings, with their diverse motives and their diverse intentions, make and transform the world which they live in*)	Walther (2014)
	Behavioural Decision Theory	Oduor and Oinas-Kukkonen (2017)
Education Training and skills development Business opportunities Stable employment	Government's e-Strategy and Initiatives theories	Heeks and Bailur (2007)
	The Diffusion of Innovation (DOI) Theory	Rana et al. (2011)
	Technological Acceptance Model	Norris and Moon (2005)
	e-Government maturity models	Andersen and Henriksen (2006)
Access Communication Sustainability Capability ICT4D	Digital Divide / Inequalities Theory	Van Dijk (2000) Gurstein (2003) Acka et al. (2007)
	Socio-Technical System Theory	Simpson (2005) Bailur (2007) Avgerou (2010) Attwood et al. (2013)
	ICT4D Research Theory	Heeks (2007)
Community members Ward Councillors Municipality officials Civic organisation NGOs Small businesses Farmers	Stakeholder Mapping Theory	Missonier and Loufrani-Fedida (2014)
	Community development theories	McGinley et al. (2010) Peredo and Chrisman (2006)

Initial Codes (Open Coding)	Potential Theoretical Areas	Key Literature
Police Religious organisation (e.g. churches) Youth social societies Schools Health facilities (Clinics)	Systems Thinking Theory	Davis et al. (2014)
e-Strategy e-Centres Communication Bandwidth and Broadband User experience e-Services	Task-Technology Fit (TTF) Theory *(TTF theory holds that IT is more likely to have a positive impact on individual performance and be used if the capabilities of the IT match the tasks that the user must perform)*	Goodhue and Thompson (1995)
	Bandwidth Theory	Burke and Chidambaram (1999)
	Technology Acceptance Model (TAM) (*how users accept and use a technology*)	Davis (1989)
The National Government EA plan Lack of proper community representation Lack of proper ICT infrastructure Rural community terrain	Systems Thinking Theory	Mingers (2003) Mingers and White (2010)
	Theory of Cognitive Integration	Sethi and King (1999)
	e-Government theory and practise	Meneklis and Douligeris (2010)
	Theories and practices of rural development administration	Ellis and Biggs (2001) McAveary (2009)
Intermittent Internet Data costs Lack of or insufficient ICT training Poor connectivity Insufficient exposure to ICT applications	ICT Adoption Theory	Korpelainen (2011)
	Task-Technology Fit Theory	Goodhue and Thompson (1995) Jacobs and Hart (2012)
Lack of capacity Access times Lack of community representatives Limited usage The place of the situation (venue)	Technology Acceptance Model	
	DeLone and McLean's IS Success Model *(An information system [IS] theory which seeks to provide a comprehensive understanding of IS success by identifying, describing, and explaining the relationships among six of the most critical dimensions of success along which information systems are commonly evaluated)*	

Step 2

Developed Categories (Axial Codes)	Refined Theoretical Area	Theoretical Perspective	Key Literature
Community challenges	Community and e-Government theories	Social Sciences: Economics, Anthropology	
Government strategy		Systems Theory Organisational Theory	
ICT issues		Task-Technology Fit Theory Technology Acceptance Theory Diffusion of Innovation Theory Adoption theory	
Bounded rationality		Cognitive Psychology Management Sciences Political Science	

Step 3

Central Categories (Selective Code)	Matched Theory	Mode of Adoption	Key Literature
Rural and underserved communities' lack of participation	Participatory Design Theory	Abduction of core fundamentals	Puri and Sahay (2007)

APPENDIX I: OTHER SOCIAL THEORIES

INTRODUCTION

Social theories, especially in the IS field, have broadened its theoretical base by finding social theories that explain an IS phenomenon, primarily a phenomenon that involves the societies. Social theories such as actor-network-theory (ANT), structuration theory (ST), and critical social theory (CST) continue to affect certain IS phenomena and their characteristics (Hirschheim & Klein, 2010). The provided list of social theories is not exhaustive; suffice to state that the few stated social theories are the influential community development drivers. The prestigious sociologists like Karl Marx, Emile Durkheim, and Max Weber have had a profound influence on how these social realities came into being (Keim, 2014).

ACTOR-NETWORK-THEORY

During the 1980s, French science and technology academics, Michel Callon, Bruno Latour and the sociologist, John Law are credited with developing the actor-network-theory (ANT) (Salter, 2019). Actors or rather 'actants' are heterogeneous, bringing together humans and non-humans to determine social interactions and outcomes. Heeks and Stanforth (2015:36) view the interaction as "pragmatics, recursive sociology".

Latour (1986:264) argues that "the problem of power is encapsulated in the following paradox: when you simply have power - in potentia - nothing happens, and you are powerless; when you exert power - *in actu* - others are acting and not you". Stanforth (2006) argues that understanding power relations among actors is necessary to define the association and oblige actors to remain faithful in their alliances. In addition, Law (2009) argues that ANT is descriptive, rather explanatory, telling stories how the relations assemble or its lack thereof. In the relations, power dynamics are described.

Callon (1984:196) calls the act of bringing together actors "*translation model of power",* because it involves the aligning of interests such as goals, problems and solutions to the demands of the actor-network. Translation happens a multiple of times across time and space through negotiations, refining, and improving the network. So, ANT aims to understand where power lies among the actors. To make translation possible, Callon (1984:203) suggests four moments of translation:

- **"Problematisation":** The principal actors (the researchers) make themselves indispensable to the other entities by defining the nature of the problem and forcing the others to accept a way forward
- **"Interessement":** The principal actors lock the others into place by interposing themselves and defining the linkages between the others (the research program becomes the recognised obligatory point of passage between the global and the local)
- **"Enrolment":** The principal actors define the roles and the relationship with one another within the networks
- **"Mobilisation":** The principal actors borrow the force of their passive agent allies and turn themselves into their representatives or spokespeople

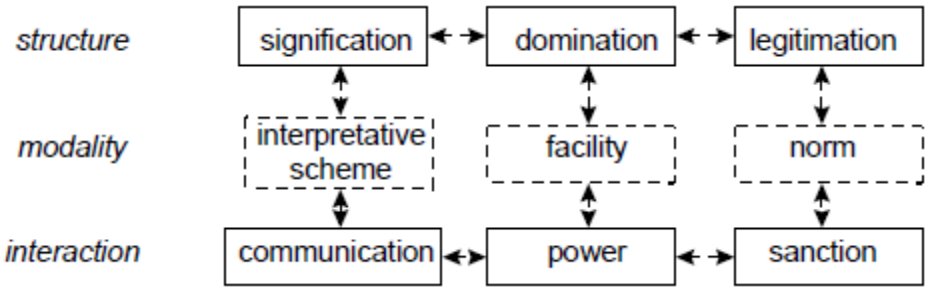
ANT was initially developed primarily for sociology, anthropology, and science and technology studies. ISs are socio-technical systems, well suited for ANT usage. IS research has successfully demonstrated the interaction of people, process and technology infrastructure. ANT used a theoretical lens assisting in creating a diverse network which consists of humans and objects (non-humans) with related interests through the use of the four moments of translation mentioned earlier (Iyamu & Sekgweleo, 2013).

While ANT recognises all actants, both human and non-human, as equal, this stance misrepresents the causal capacities of human actors, and reduces the capacities of human beings to think and act (Elder-Vass, 2019).

STRUCTURATION THEORY

In the 1960s and early 1970s, an orthodoxy was diminishing in the social theory world until the British sociologist, Anthony Giddens, contributed to the reconstruction and renewal of social theory by developing the structuration theory (ST) (Broger, 2011). In the 1970s and 1980s, Giddens was a prolific writer of articles and books, criticising some of the orthodox sociological views. This series of criticism culminated with the publication '*The Constitution of Society*' in 1984, explaining the fundamental issues in contemporary social theory. ST is the process whereby the duality of structure, namely human agents and structure, evolve and reproduce over time and space (Rose & Scheepers, 2001). Rose and Scheepers (2001) list the central tenets of ST, clarifying that human social activities are recursive. The main tenets are:

- **Agency:** Giddens (1984:24) views human agencies that are connected with transformational power as capable of making the difference in social interaction. Transformation power generally draws two kinds of resources. First, authoritative resources required to coordinate and manage human activities. Second, allocative resources necessary to execute the material products
- **Structure:** Giddens (1984:24) defines structures as "rules and resources recursively" implicated in social representation. Human activities can only exist within social structures, which can include cultural and economic systems governed and kept together as a social structure
- **The duality of structure:** The duality of the structure lies at the core of ST (Giddens, 1984). Human agents regularly act to produce and reproduce and develop social structures over time-space. Giddens (1984) demonstrates that the dimensions of duality structure with social structure and human interaction is broken down into three dimensions and sandwiched in between linking modalities (Appendix I.1). The duality of structure means "that the structural properties of social systems are both the medium and the outcome of the practices that constitute those systems" (Giddens (1984:69)



Appendix I.1: Dimensions of duality structure (Giddens, 1984:29)

Structuration: Structuration is defined as "the process whereby the duality of structure evolves, reproduced over time and space" (Rose & Scheepers, 2001:220).

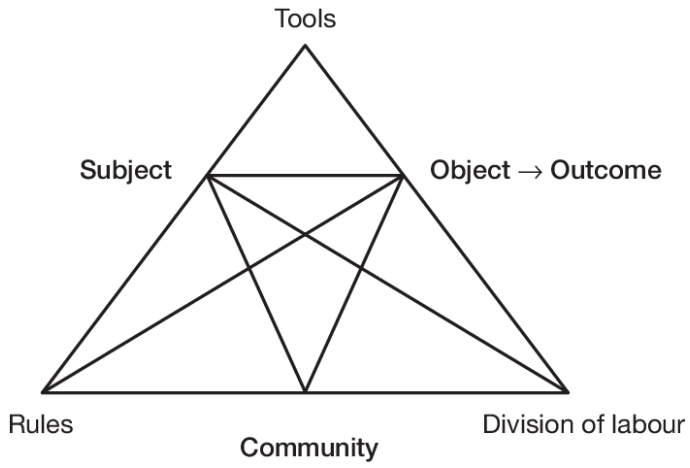
Social integration and system integration, time-space distantiation, routinisation: The actors sharing the physical space initiate social interactions, which are known as social integration, system integration, time-space distantiation and routinisation. Social integration defines the circumstances of a real encounter between agents, while system integration defines agents who are not in the same

space or context. Time-space distantiation involves the “stretching of social systems across time-space, by mechanisms of social and system integration” (Giddens (1984:377). Jones and Karsten (2003:15) define routinisation as an idea of the structure that is “continuously produced and reproduced through action leads to another significant aspect of structuration”.

These structuration theory concepts mentioned are useful in explaining IS practice (Rose & Scheepers, 2001). IS studies have used ST to analyse the context from action derived. Coad et al. (2014) used strong ST to guide management accounting case study and engaged actively in the development of ST. Gaß et al. (2015) used ST as a theoretical lens to explain individualisation in IS from the perspective of the social context. Jeffries et al. (2017:1) used ST “to understand the adoption and implementation of an electronic clinical audit and feedback tool to support medicine optimisation for patients in primary care”. Iyamu (2017) used ST to understand that analysis, organisational structure, technology, social context, and process-oriented factors are critical to EA complexities.

ACTIVITY THEORY

Activity theory (AT), also known as the cultural-historical theory of activity, is counted among a plethora of social theories. AT is for human consciousness, interpreting consciousness as “the product of an individual’s interactions with people and artefacts in the context of everyday practical activity” (Kaptelinin & Nardi, 2006:8). Cole and Engeström (1993) argue that AT is based on the assumption that man and artefacts form a dual process of shaping and being shaped by the social and physical environment. AT, therefore, aims to conceptualise human activities to shape or be shaped by the physical environment (Cole & Engeström, 1993). However, according to McMichael (1999:612), the German and Russian languages provide a more precise definition of the term “activity”, which is the conscious behaviours with defined goals, performed by individuals or a group. The basic tenet of AT is that actions are always connected to a frame of reference created by a similar activity which is comprised of a subject, object, actions and operation, as shown in Appendix I.2.



Appendix I.2: The mediational structure of an activity system (Cole & Engeström, 1993:38)

Each object of an activity is brought into existence by a need or a desire to which the activity is an answer. An object can be concrete or elusive, like a plan or a common idea. A subject is a person or a group engaged in an activity. The subject motivates an object, which motivates an activity. The result of an activity is an outcome. An activity is, therefore, a collective phenomenon. This idea brings into existence what Cole and Engeström (1993:9) called an “activity system”. Such a system connects the subject, the object, and the community, which are mediated by tools, rules and division of labour and can be represented as a classical mediational triangle construction (see Appendix I.2).

AT acts as a theoretical lens in facilitating and assisting IS to understand work activities. This facilitation is fundamental to the work of IS, which coordinates and communicates work activity. Karanasios et al. (2015) have applauded AT's growth in understanding technology-mediated changes within organisational settings, and contradictions that often arise within the activity system. AT assist in systems development. Iyamu and Shaanika (2019) used AT to focus on understanding the context of human activities within a social system and the environment. Jussila et al. (2019:2923) used AT "as a lens to identify the similarities and differences between the private and public sector in the development and implementation of a new government digital service".

CRITICAL SOCIAL THEORY

Critical theory, as it was first known, was derived from the German's Frankfurt School of Sociology through Max Horkheimer's seminal paper, "*Traditional and Critical Theory*" in the 1930s (Horkheimer, 1937). Critical theory aims to move further than understanding or explaining the societal phenomenon towards critiquing and implementing changes to society as a whole. In the 1960s, Jürgen Habermas was a second generation prominent sociologist who impacted the theories on communicative rationality through a theory or set of theories that describes human rationality as a necessary outcome of successful communication (Klein & Huynh, 2004).

Critical social theory (CST) as it was later commonly known focuses on radical, emancipatory change within the society by critiquing the model of science used in IS research (Ngwenyama, 2005). Crossley (2005) cites some of the critical concepts of CST:

- Assumes that the society's historical background is significant in constructing social reality
- It embraces the *imminent critique,* which, according to Antonio (1981:330), "focuses on the internal tensions of the theory or social form under analysis". The immanent critique aims at analysing and identifying (a) prospects for progressive social change and (b) those structures of society and consciousness that contribute to human domination" (Antonio, 1981).

Through its approach of seeking to understand the society, CST is multidisciplinary, integrating major social sciences such as those "which combine perspectives drawn from political economy, sociology, cultural theory, philosophy, anthropology, and history" (Kellner, 2012:11).

Ngwenyama (2005) argues that CST research and practice in IS is grounded on five fundamental assumptions:

(1) People occupy the centre stage of the social world. They are the reason for any change.

(2) Scientific knowledge is socially constructed and is value-laden. Value orientations can be identified in both implicit and explicit forms of ideology held by the researchers.

(3) Reason and critique are inseparable.

(4) Theory and practice ought to be inseparably interconnected because the task of CST is seen as reconciling knowledge with the satisfaction of the human need for self-improvement.

(5) CST must be reflexive; that is, it must be concerned with the validity conditions of knowledge and change that it produces. Therefore, researchers following this approach must collaborate with those who will be affected by it, opening it up to public debate and critical reflection.

Lee (2002) used CST to study the managerial usage of email communication. Lee argued that human beings are capable of engaging in critical reflection, which can lead to avoiding communication mistakes such as false, incomplete, manipulative and insincere communication.

Krauss (2013) used CST as a theoretical lens to understand the practical application of the United Nations Educational, Scientific and Cultural Organisation's (UNESCO) ICT Competency Standards for Teachers policy framework in deep rural areas. He needed to understand the discord that existed between rural community teachers and UNESCO ICT policies.

Fuchs (2017) applied CST in the realm of ICT and sustainability within societies. He demonstrated how ICTs were "taken over by neoliberal policies that conceive ICTs as a realm of private capital accumulation and advances the commodification of communications and society" (Fuchs, 2017:2456). This phenomenon explains why ICTs are making little or no breakthroughs in rural and underserved communities.

APPENDIX J: DESIGN SCIENCE RESEARCH GUIDELINES

(Source: Hevner et al., 2004:83)

Guideline	Description
1: Design as an artefact	Design science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
2: Problem relevance	The objective of design science research is to develop technology-based solutions to important and relevant business problems.
3: Design evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
4: Research contributions	Effective design science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
5: Research rigour	Design science research relies on the application of rigorous methods in both the construction and evaluation of the design artefact.
6: Design as a search process	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.
7: Communication of research	Design science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

APPENDIX K: FRAMEWORK FOR EXTRACTING DESIGN THEORY

(Gregor et al., 2013:8)

Design Theory Component	Abstraction Process	Reflective Questions Identified
Purpose and Scope	Identify the high-level meta-requirements or goals of the artefact. This identification can be assisted by reflecting on the original problem-solution space. The requirements may have been specified to the designer/developer, or a novel design idea may have been generated by the designer, requiring creative causal analysis.	*What was the problem the researcher originally perceived? Was the problem generated by the researcher or provided by someone else? What is the goal of the artefact?* *How did the original design idea come about? Can you give the design idea a name? Naming the concept can help thinking about it and its distinct properties as a class of things.* *What concepts formed the basis for the first tentative design? From which fields did these concepts come? Why specifically these?* *Were there subsequent problems that emerged? Did they require further innovative design ideas? What else was important?*
Principles of Form	Identify the architectural aspects (the form) of the artefact that facilitate the achievement of its goals. Identifying the architectural aspects can be assisted by reflecting on the affordances that the artefact offers, and why they work, and thus requires passive causal analysis. The analysis may be assisted by considering original or subsequent design ideas (creative causation) that are core to the linkage of design characteristics with achievement of goals.	*What material properties did the designer deliberately build into the artefact to enable it to achieve its purpose?* *What material properties of the artefact in use are observed to contribute to the emergence of the desired affordances?* *What contextual conditions are observed to enable the emergence of the desired affordances?* *Which user groups perceive which functional affordances of the artefact?* *What changes are required in the essential material of the design artefact or in the enabling contextual conditions in order to lead to the emergence of desired functional affordances?* *What justificatory knowledge provides support for the linking of the material properties to the achievement of the artefact's goals, as originally envisaged, or arising in use?*
Principles of Function	Identify the series of actions that is necessary (or close to necessary) for the artefact to achieve its goals, possibly as part of a wider artefact-actor system. Identification can be assisted by reflecting on active causation — analysing acts or interventions by an agent (human or otherwise), or an agent acting with the artefact, in a context where the act has an observable outcome.	*Which acts or interventions have to be performed to reach a specific goal?* *Who is the agent?* *In what order should the actions be undertaken?* *What are the observed effects?* *Which actions are necessary (or most necessary) to bring about desired outcomes? Why are these necessary (is there underlying support from justificatory knowledge)?*

Design Theory Component	Abstraction Process	Reflective Questions Identified
	The analysis may also be assisted by considering original or subsequent design ideas (creative causation) that are core to the linkage of design characteristics with achievement of goals.	*Which actions are incidental to the outcome (where some other action could likely serve the purpose just as well)?*

APPENDIX L: SUCCESS FACTORS FOR PARTICIPATORY DEVELOPMENT THEORY

(Source: Haikin & Duncombe, 2013)

Factor	Description
Preparing for participatory ICT4D	• **Motivation (to empower):** Genuine motivation of external agents to include the local community in decision-making with a view to empowerment/emancipation • **Bottom-up community-centric approach:** Participation of beneficiaries/ communities at every stage, from initial goal setting onwards; reversing power – improving the bargaining position of the poor; draw on and build capabilities of the community and residents • **Political and social awareness of external agents:** Understand the relevance of complex local power structures, the influence of powers above and below the community (household, local/national government, market), the tension between the quality of product and process, and between innovation and sustainability, dangers of co-optation • **Who participates?** Representation of the needs of all groups, especially the marginalised participants; appreciate tension between identifying technology champions and including the most marginalised • **Ability to participate**: Participants need motivation, skills and opportunity to participate
Delivering participatory ICT4D	• **Iterative development lifecycle**: Increasing involvement at each stage, starting small and building up • **Manage power imbalances and group dynamics:** Understand the relevance of complex local power structures. Understand the influence of powers above and below the community (household, local/national government, market). Manage group dynamics to avoid unfair outcomes • **Facilitation and the role of the external agent**: Appreciate the appropriate role and value of external experts and the potential for unintended influence. Build trust between external experts and the local community. Work with different stakeholders both together and separately • **Choice of methods and techniques**: Understand the suitability of different methods for different levels of skills, context etc. Draw on different participatory design/development methods for different phases and contexts • **Pragmatism**: Recognise situations in which technical limitations may take precedence over local needs
Sustaining participatory ICT4D	• **Capacity builds local institutions**: Work with and evolve existing structures and processes where possible. Develop the capacity of local institutions • **Up-skill local individuals**: Manage latent need – phased approach required which builds a technological understanding of participants over time to enable them to participate effectively. Develop skills of local people. Capacity build locals to become IT, planners/designers • **The increasing level of participant:** Involvement throughout the programme; Towards eventual local control as soon as practical • **Long-term view**: Aiming for long-term empowerment and success, not just immediate impact

APPENDIX M: SAMPLE OF THE INTERVIEWS

All interview transcripts are stored on a CD.

APPENDIX N: SAMPLE OF FOCUS GROUP RESPONSES

Transcripts are stored on a CD.

APPENDIX O: QUALITY APPRAISAL ASSESSMENT OF 138 SLR ARTICLES

(Adapted from Hawker et al., 2002)

Appendix O.1: Assessment Form 1: Reject/Accept

Author(s):	Date of Publication:
Abbreviated Title:	
Reviewer:	

Relevance to research questions

[ ] How effective are existing methods?

[ ] What are the formal and informal strategies for transfer of information?

[ ] To what extent is information technology used?

[ ] What factors are associated with the breakdown of communication?

Intracommunication

[ ] Focus or major part of study

[ ] Minor part of study

[ ] Mentioned in discussion/results

Intercommunication

[ ] Focus or major part of study

[ ] Minor part of study

[ ] Mentioned in discussion/results

Study Type: - (ring)

[1] Empirical study—Peer reviewed

[2] Theoretical paper—Peer reviewed

[3] Research paper—Non–peer reviewed

[4] Theoretical paper—Non–peer reviewed

[5] Professional document

[6] Case study

[7] Other

Comment:

Appendix O.2: Assessment Form 2

Author(s):	Date of Publication:
Abbreviated Title:	
Assessor:	Date Assessed:
Study Design [ ] Quantitative [ ] Qualitative [ ] Combination	Location of Study: Sample - Description: Sample-Size:
Aim: Research Questions/Hypothesis (If any): Method and analysis: Intervention (if applicable): Results: Conclusions, comments, and issues raised:	

Appendix O.3: Assessment Form 3

Author and title: Date:					
	Good	**Fair**	**Poor**	**Very Poor**	**Comment**
1. Abstract and title 2. Introduction and aims 3. Method and data 4. Sampling 5. Data analysis 6. Ethics and bias 7. Findings/results 8.Transferability/generalisability 9. Implications and usefulness Total					

Appendix O.3.1

Abstract and title: Did they provide a clear description of the study?	
Good	Structured abstract with full information and clear title
Fair	Abstract with most of the information
Poor	Inadequate abstract
Very Poor	No abstract
Introduction and aims: Was there a good background and clear statement of the aims of the research?	
Good	Full but concise background to discussion/ study containing up-to-date literature review and highlighting gaps in knowledge Clear statement of aim AND objectives including research questions
Fair	Some background and literature review Research questions outlined
Poor .	Some background but no aim/objectives/questions, OR Aims/objectives but inadequate background
Very Poor	No mention of aims/objectives No background or literature review
Method and data: Is the method appropriate and clearly explained?	
Good	Method is appropriate and described clearly (e.g. questionnaires included) Clear details of the data collection and recording
Fair	Method appropriate, description could be better Data described
Poor	Questionable whether method is appropriate Method described inadequately Little description of data
Very Poor	No mention of method, AND/OR Method inappropriate, AND/OR No details of data
Sampling: Was the sampling strategy appropriate to address the aims?	
Good	Details (age/gender/race/context) of who was studied and how they were recruited Why this group was targeted The sample size was justified for the study Response rates shown and explained

Fair	Sample size justified Most information given, but some missing
Poor	Sampling mentioned but few descriptive details
Very Poor	No details of sample
Data analysis: Was the description of the data analysis sufficiently rigorous?	
Good	Clear description of how analysis was done Qualitative studies: Description of how themes derived/respondent validation or triangulation Quantitative studies: Reasons for tests selected hypothesis driven/numbers add up/statistical significance discussed
Fair	Qualitative: Descriptive discussion of analysis Quantitative
Poor	Minimal details about analysis
Very Poor	No discussion of analysis
Ethics and bias: Have ethical issues been addressed, and what has the necessary ethical approval gained? Has the relationship between researchers and participants been adequately considered?	
Good	Ethics: Where necessary, issues of confidentiality, sensitivity, and consent were addressed Bias: Researcher was reflexive and/or aware of own bias
Fair	Lip service was paid to above (i.e., these issues were acknowledged)
Poor	Brief mention of issues
Very Poor	No mention of issues
Results: Is there a clear statement of the findings?	
Good	Findings explicit, easy to understand, and in logical progression Tables, if present, are explained in text Results relate directly to aims Sufficient data are presented to support findings
Fair	Findings mentioned but more explanation could be given. Data presented relate directly to results
Poor	Findings presented haphazardly, not explained, and do not progress logically from results
Very Poor	Findings not mentioned or do not relate to aims
Transferability or generalisability: Are the findings of this study transferable (generalisable) to a wider population?	
Good	Context and setting of the study is described sufficiently to allow comparison with other contexts and settings, plus high score in Question 4 (sampling)

Fair	Some context and setting described, but more needed to replicate or compare the study with others, PLUS fair score or higher in Question 4
Poor	Minimal description of context/setting
Very Poor	No description of context/setting
Implications and usefulness: How important are these findings to policy and practice?	
Good	Contributes something new and/or different in terms of understanding/insight or perspective Suggests ideas for further research Suggests implications for policy and/or practice
Fair	Two of the above (state what is missing in comments)
Poor	Only one of the above
Very Poor	None of the above