Mapping the landscape of sustainability in ICT4D: a systematic literature review

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Submitted in fulfilment of the requirements for the degree
MIT in Information Systems

in the

FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

at the

UNIVERSITY OF PRETORIA

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15 June 2019

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ABSTRACT

The concept of sustainability in Information and Communication Technology for Development (ICT4D) has been largely associated with the sustainability of ICT4D projects. In other words, most ICT4D literature consider the “continuous operation of ICT4D projects” as the sustainability of ICT4D. This implies that the failure of these ICT4D projects threatens or compromises the existence of sustainability in ICT4D (Heeks, 2002). In this study we do not argue that this view is false; however, sustainability in ICT4D should be considered from a broader perspective, and should not be limited to the uninterrupted operational success of ICT4D projects.

Sustainability in ICT4D has proven a challenge to put into practice. This is as a result of a number of known and unknown elements that should be independently and sometimes collectively considered in the implementation of ICT4D, to enable sustainability and sustained benefit realisation. Therefore, this study undertakes a systematic literature review that aims to identify and understand aspects that could enable or disable sustainability in ICT4D within the context of developing communities. Furthermore, based on the analysis and findings from the systematic review of selected ICT4D articles, sourced from various academic journals and conference proceedings, the researcher proposes a framework that seeks to illustrate the building blocks of sustainability in ICT4D. The proposed framework emphasises critical elements that require consideration in ICT4D implementations, so as to enable the realisation of sustained socio-economic benefit for local livelihoods.

Keywords: ICT, ICT4D, Sustainability, ICT4D Sustainability, Developing Community, Framework, Initiative(s), Project(s)

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to the following individuals and institutions who made it possible to complete this study, and whose encouragement and support are deeply valued. Special appreciation goes to:

My supervisors, Dr. M. Turpin and Prof. M. Matthee, for their guidance and support that made this study possible.

My family, for motivating me to not give up on completing the study and on obtaining my Master's degree.

My life partner Libertine Makinta, for the emotional support and for allowing us to engage in ICT4D theory.

Above all, I would like to thank KPMG (my current employer) for sponsoring my fees, and The University of Pretoria for giving me a chance to conduct this study, which has expanded my knowledge of the field of Information Systems.

GLOSSARY

Term/Abbreviation	Explanation
ICT	Information and communication technology; it includes technologies that enable access to information by means of telecommunications (Heeks, 2010).
ICT4D	Information and communication technology for development is a field of study that considers the utilisation of ICT to address social and economic inequalities in marginalised communities by bridging the digital divide (Heeks, 2002).
ICT4D Sponsor	An individual or an organization (such as a government or a private entity) that pays for, or contributes towards, the costs associated with the implementation of ICT-enabled development (Angerer & Hammerschmid, 2005).
Developing Community	An impoverished settlement that seeks to advance socially and economically by adopting ICT-enabled development (Breytenbach, De Villiers, & Jordaan, 2013).
Digital divide	The noticeable gap that exists in developing communities between those who enjoy the privilege and advantage of having access to computers and the internet, and those who do not have such privilege of access (Heeks, 2010b).
Framework	A conceptual structural representation of building blocks that suggest collaboration in order to help realise the sustainability of ICT4D in developing communities, with reference to the purpose of this research as presented in Section 1.2 of Chapter 1 (Oxford University Press, 2018).
Initiative/intervention	Refers to the broader implementation of ICT4D as a method to alleviate the socio-economic challenges that face developing communities.
SLR	Systematic Literature Review.
Sustainability	“The ability to maintain at a particular rate or level” (Oxford University Press, 2018).

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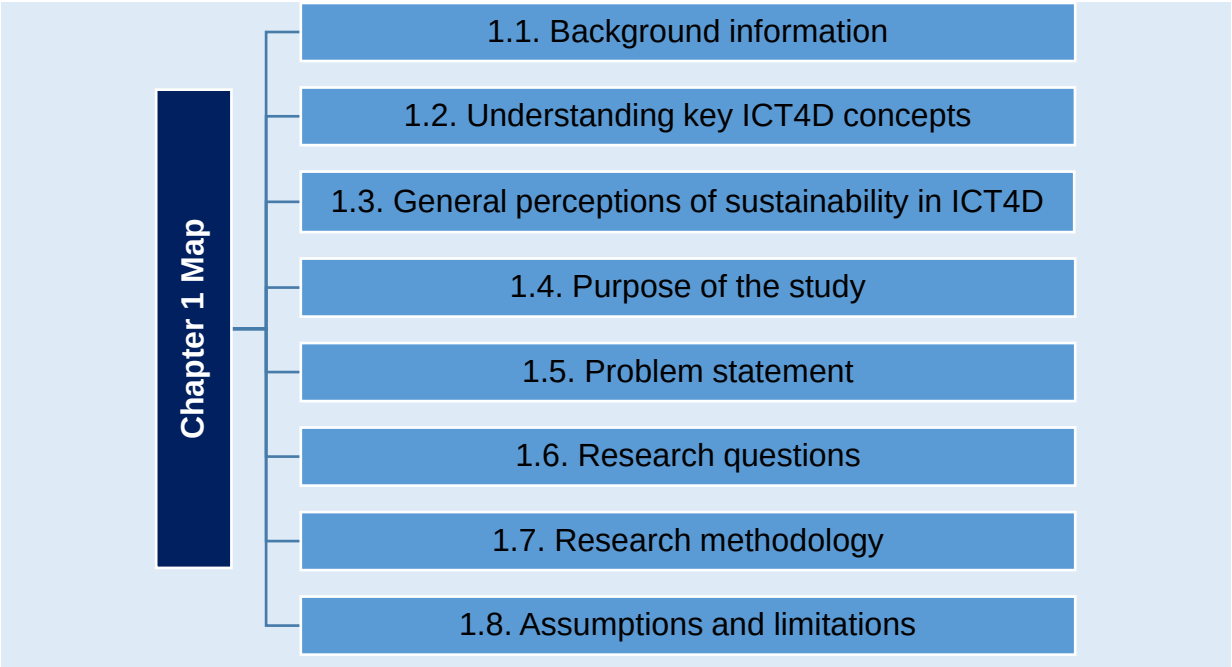
1 INTRODUCTION



1.1 BACKGROUND INFORMATION

Governments of many developing nations, in partnership with global agencies such as the World Bank and United Nations, continue to invest in ICT4D interventions. This is in an attempt to alleviate socio-economic challenges such as poverty, crime, the burden of disease, and illiteracy that face the majority of people in developing countries (Ng & Tan, 2018).

Although ICT4D interventions are aimed at improving the quality of local livelihoods by bridging the digital divide between disadvantaged and advantaged social groups, studies in the ICT4D discipline show that a significant number of developing countries often do not realise the intended socio-economic benefit from ICT4D initiatives. Heeks (2002) categorises this ICT4D project failure as either total or partial failure. Total ICT4D project failure indicates that the intended development benefits are never realised. On the other hand, partial ICT4D project failure refers to a minor extent to the development benefits that are realised prior to the eventual failure of the ICT4D initiative(s).

A number of ICT4D studies have argued that the failure of ICT4D projects in developing communities across the globe results from an infinite number of tangible and intangible factors and their interactions. The extent to which these factors and interactions contribute towards sustainability in ICT4D interventions varies, and factors are prioritised differently by the authors of ICT4D studies. These diverse views or opinions trigger the need to understand the core attributes that constitute sustainability in ICT4D interventions in the context of developing communities. In doing so, stakeholders of ICT4D initiatives can acknowledge and consider the criticality and impact of these various attributes when adopting ICT4D initiatives, to enable sustainability and realise sustained socio-economic benefit (Naveed, Hamid, & Prashant et al, 2015).

A number of studies pertaining to the phenomena of sustainability in ICT4D have been, and continue to be, conducted with the intention of helping communities in developing contexts to implement ICT4D initiatives efficiently and effectively. However, it is not practical for ICT4D stakeholders to take into account the findings and recommendations of all published studies. This is because each study varies when put into the context of the intended developing community. Despite this contextual variance, certain fundamental factors and interactions pertaining to the sustainability of ICT4D interventions are identifiable in a set of studies. This study aims to uncover these common factors and interactions that are perceived in the ICT4D literature as enablers of sustainability in ICT4D, so as to illustrate a generic view of what constitutes sustainability in ICT4D initiatives.

Some studies argue that the “availability of technology” is essentially the main driver of sustainability in ICT4D initiatives. This means that, for ICT4D initiatives to be considered sustainable, the hardware and network infrastructure (including the software used as medium of ICT4D) should be consistently operational, without any interruptions to its availability (Heeks, 2010b; Duncombe, 2006; Donner, 2007; Esselaar, Stork, Ndiwalana, & Deen-Swarray, 2007).

Other ICT4D researchers state that, although availability of technology is an important factor, sustainability in ICT4D interventions is about maintaining a positive impact on local livelihoods through continuous benefit realisation. This implies that technology can be available but not utilised by locals if it does not positively influence or benefit

the lives of the target developing community. In such cases, the “community context” in which technology is implemented becomes the primary driver of sustainability in ICT4D, and not necessarily the availability of technology (Duncombe, 2006).

Although ICT4D initiatives are intended to positively impact developing communities by increasing social and economic opportunities, ICT4D initiatives could have undesired outcomes if not implemented and adopted appropriately (Meera, 2010). The majority of developing countries that invest in ICT4D initiatives fail to achieve the intended social-economic development objectives. These objectives are aimed at benefiting the target developing population by bridging the digital divide (Zuofa & Ochieng, 2014).

Heeks (2002) identifies a few common reasons as contributors to ICT4D project failure. These include mismanagement of limited critical resources, lack of the inclusion of local people in the ICT4D design and implementation phase, the complexity and expensive nature of the technology used, limited training and support in ICT4D adoption, and lack of commitment and participation from macro-level ICT4D stakeholders (such as governments and donor agencies). Such ICT4D project failure compromises sustainability, including the realisation of sustained benefit that is needed to improve local livelihoods.

Sustainability in ICT4D interventions is about ensuring continuous development efforts that meet the current and future social and economic needs of the target population. Continued development benefit should be realised by local people, despite the challenges and/or opportunities that arise from ICT4D implementations. Secondly, the present and future needs of local people, irrespective of their demographics, should not depend on the success or failure of ICT4D initiatives. Gunnstam and Nordquist (2009) state that the failure of ICT4D initiatives to be sustainable derails developing communities from achieving the envisioned economic and social development goals. Therefore, there is a need to understand the factors and interactions that promote sustainability in ICT4D initiatives. This is necessary to minimise the wastage of already limited resources, and enable ICT4D stakeholders to engage in informed decision making.

1.2 UNDERSTANDING KEY ICT4D CONCEPTS

The ICT4D concept essentially comprises two fundamental aspects, namely information and communication technology (ICT) and development. Brewer (2005) characterises ICT as the combination of infrastructure (hardware and network) and software that is required to enable the transmission or exchange of data between multiple end points. Development is the second aspect of ICT4D, which is primarily focussed on improving local livelihoods in developing communities from a social and economic perspective (Brewer, 2005).

The implementation of ICT4D initiatives has gained popularity in a number of developing countries including South Africa, where the local government continues to invest in ICT across various sectors, including health and education, to enhance development efforts. Brewer (2005) argues that this increase in ICT investment is largely driven by ICT4D being viewed as an enabler of social and economic development and benefit realisation that positively impacts the intended target population. Some examples of anticipated development benefits, that are understood to result from ICT investments across multiple societal spheres, include improved literacy among local people, job creation, as well as a reduction in poverty and crime. Many of these ICT4D investments are undertaken by developing countries in partnership with certain developed nations and humanitarian and developmental organisations such as the United Nations and The World Bank (Kleine & Unwin, 2009).

Although the intentions of ICT4D initiatives are to benefit the lives of local people, the implementation of these initiatives does not always guarantee a positive impact, as intended. Most ICT4D research indicates that numerous challenges face ICT4D implementations. Some of these challenges result in the failure of ICT4D initiatives prior to the realisation of the anticipated benefits that are aimed at improving the quality of local livelihoods by bridging the digital divide, thus proving to be obstacles to sustainability. ICT4D literature investigates the failure of ICT4D initiatives by comparing what the ICT4D intervention aimed to achieve against what was actually achieved or not achieved relative to the target population's development context (Heeks, 2002).

Heeks (2002) categorises ICT4D project failure into total and partial failure. Total failure is when the introduction of ICT fails to realise the anticipated benefits that would depict development in the context of the target community. On the other hand, partial failure is related to minor development that is observable as a result of ICT implementation. However, both categories of ICT4D project failure hinder sustainability in ICT4D implementations and sometimes worsen the status quo in the developing communities. It is important to understand that many developing countries have limited budget capacity and cannot afford to invest in failing ICT4D initiatives. This is because the resources wasted in such initiatives could have been prioritised towards other development efforts such as the building of shelters, schools, or sanitary facilities (such as flushing toilets) in local communities, particularly in rural areas in the case of South Africa (Chigona, Pollock, & Roode, 2009).

In summary, ICT4D is intended to bridge the digital divide and promote socio-economic development through the application of ICT to help poor and marginalised communities. The emphasis of ICT4D is to use technology for the betterment of the target developing community.

1.2.1 Defining the term Sustainability

In order to comprehend sustainability in ICT4D, the researcher first unpacks the meaning of the term “sustainability”. While ICT4D authors define this term differently, there is commonality in the manner in which the term is defined. Similar themes can be identified from various definitions that have been published in literature, including in reputable English dictionaries such as The Oxford English Dictionary (Ali & Bailur, 2007).

According to the Oxford English Dictionary, sustainability is defined as a manner of maintaining something at a certain level, rate, or standard; “to support the efforts of; to sustain; to keep something away from failing or forfeiting”. Failure to maintain the presumed state is therefore considered as unsustainability (Oxford English Dictionary, 2006: 326-327).

Fowler (2000) states that the meaning of sustainability is associated with support, maintainability, perpetuation of something, preservation, and the avoidance of failure. Furthermore, Fowler argues that sustainability entails a parallel balance between two qualities, namely, stability and progression. Together, these two qualities enable sustainable development, which is defined as development that caters for the needs of the present generation without jeopardising the capacity of future generations to satisfy their own needs as well. This implies that the achievement of sustainability enables sustainable development, as observed through the realisation of sustained benefit in the context of the subject community (Brundtland, 1987).

1.3 THE PERCEPTIONS OF SUSTAINABILITY IN ICT4D – GENERAL BACKGROUND

1.3.1 General Categories perceived to impact Sustainability in ICT4D

Sustainability in ICT4D generally consists of five categories. Four of these categories of sustainability are acknowledged in most ICT4D studies as drivers of sustainability in ICT4D. These include economic (also known as financial) sustainability, social/cultural sustainability, political (a part of institutional) sustainability, and technological sustainability. The fifth category is environmental sustainability, which is the least recognised in ICT4D studies, but is ironically where the origin of the term sustainability can be traced to. ICT4D authors have different views regarding the importance or priority of each sustainability category in its contribution towards achieving sustainability in ICT4D initiatives. However, most authors agree that countries that undertake ICT4D investments should consider the requirements of these sustainability categories, based on their community context, in order to drive and perhaps achieve sustainability in ICT4D (Ali & Bailur, 2007; Best & Kumar, 2008; Silivus, Van Den Brink, & Smit, 2009; Tanner & du Toit, 2015).

Pade-Khene, Mallinson, and Sewry (2011) state that, depending on the target community's development context, the priority of these categories can be alternated on a need-to-have basis. Although all categories are important to the achievement of sustainability in ICT4D, the degree of their independent or dependent impact may differ, based on the context of the target developing community. Most ICT4D research

emphasise the economic or financial categories of sustainability as the most critical, due to the operational costs that are mandatory for sustaining an ICT4D intervention. The operational costs are largely driven by the cost of technology, which is why the economic and technological sustainability categories are interlinked. However, it is important to consider and understand how developing communities are impacted by all of these general categories, individually and collectively. Thereafter, the ICT4D intervention should be tailored to reflect the need for consideration of each category on the basis of the context of the target community (Kleine, 2010). These five general sustainability categories are elaborated in more detail below.

i. Financial or Economic Sustainability

Financial sustainability, also known as economic sustainability, is concerned with the monetary ability that is required to maintain the operational costs of the ICT4D initiative. Some examples of such costs include purchasing and maintenance of ICT infrastructure, connectivity (bandwidth) costs, software licence costs, and others. All these financial needs have to be provided for in a perpetual manner that ensures the opportunity of achieving sustainability in ICT4D implementations. This can be done through a self-funding model, agreed upon continuous donor funding, or government sponsorships (Proenza, 2001).

The majority of ICT4D initiatives are donor-funded by Non-Governmental Organisations (NGO), Private Companies, or International Humanitarian Organisations. These institutions ordinarily provide funding for a finite period. There is expectation from donors that the initiative will self-sustain by generating the necessary income from the target population. Further to this, agreements are in some cases reached between donor agencies and local government officials to subsidise the ICT4D intervention post donor involvement (Kumar, 2005).

However, financial sustainability continues to be a challenge for most countries that undertake ICT4D investments, as funds deplete without fulfilling their intended purpose. This depletion of funds can be attributed to a number of causes including, but not limited to, corruption, poverty, and mismanagement of funds. All these negative attributes create financial instability for ICT4D implementations, which hinders the opportunity to achieve sustainability in ICT4D.

ii. Political or Institutional Sustainability

According to (2008), institutional sustainability is concerned with ensuring that the goal of achieving socio-economic development through ICT is properly guided by means of well-articulated structures and processes. These structures and processes set a purposeful direction through policies and standards; these are intended to govern and ensure the effective and efficient usage of ICT in the achievement of socio-economic development goals to enable improvement of the quality of life of the target population (Kumar & Best, 2006). Institutional sustainability is about establishing common ground between the key stakeholders involved in ICT4D, such as political actors, local community, and local or international donor agencies. Furthermore, institutional sustainability aims to ensure that each participant engaged in ICT4D continuously understands and accepts their roles and responsibilities to help drive the development efforts using ICT (Madon, 2005).

iii. Social or Cultural Sustainability

Pade-Khene *et al.* (2011) state that social sustainability emphasises the significance of prioritising the needs of the intended developing community. In other words, at the centre of ICT4D is an understanding of the needs of the local people, and the ability of ICT development efforts to continuously adapt to the dynamic nature of these needs without compromising the needs of future generations.

Social sustainability entails persistent ICT4D community acceptance and participation, generally driven by positive benefit realisation that improves the lives of the target population. Furthermore, to promote social sustainability, stakeholders of ICT4D interventions (e.g., donor agencies, government departments, NGOs, and private companies) should engage and collaborate with local people to better understand their circumstances, so that the ICT4D intervention can be tailored in a manner that complements the context of the target developing community. Kumar and Best (2006) reveal that it is this tailored ICT4D solution, reflecting the needs of the recipient developing community, that will enhance the user buy-in and involvement that is required to achieve social sustainability.

iv. Technological Sustainability

Technology is a critical component that forms part of the context that shapes the developing community. It is a characterised by volatile progressive components in the form of tangible (hardware) and intangible (software) components, as well as networks (connectivity). Collectively, these components are perceived as an ICT mechanism that can be used for development efforts by bridging the digital divide. Avgerou and Walsham (2000) mentions that the ability to keep up with the volatility of technology has proven difficult to sustain for most developing countries that intend to use ICT for development. This is largely due to the high costs associated with the purchase and maintenance of evolving technology. Moreover, the evolving nature of technology results from innovation influenced by market competition and demand, makes it expensive and unaffordable for developing communities to participate or deploy ICT for the benefit of local livelihoods.

Technological sustainability is difficult to achieve when technological changes cannot be afforded or maintained. New hardware, software, and network technologies offer a lot of advantages such as increased interaction, faster processing capabilities, bug fixes, better support, and many others. Nonetheless, these positive technological benefits co-exist with possible negatives that hinder sustainability in ICT4D, namely, affordability concerns, complicated interfaces with complex navigation (due to lack of user inclusion in the ICT design), compatibility concerns, and in some cases a lack of support for older versions of technologies by manufacturing companies that promote the sale of their new products and solutions (Ali & Bailur, 2007; Pade-Khene *et al.*, 2011).

In summary, technological sustainability entails prolonging the existence of technology without significant hardware or software changes that may affect its availability and durability. The sustainability of technology is in other words the ability of technology to operate simply, allow for flexibility, be easily maintainable, and be available when needed. Financial sustainability is also required to support technological sustainability by generating capital or income to cover the costs of the required technology.

v. Environmental Sustainability

The ICT4D research community emphasises on the significance of environmental sustainability in the implementation of ICT4D initiatives. Environmental sustainability in ICT4D is viewed by Kumar and Best (2006) as the capacity of the developing community to dispose of or recycle ICTs with the goal of minimising the pollution that might arise when these technological artefacts are no longer being used.

1.4 PURPOSE OF THE STUDY

The perceptions discussed in Section 1.3 provide an overview of how sustainability in ICT4D can generally be understood. This study aims to navigate through existing ICT4D literature by using a systematic literature review (SLR) research strategy to determine and understand the broader perceptions of what constitutes sustainability in ICT4D within the context of developing communities. Based on this understanding, this researcher aims to present a framework that incorporates and illustrates the common features that enable or disable sustainability in ICT4D.

1.5 PROBLEM STATEMENT

The implementation of ICT4D initiatives in developing countries around the world continues to increase. This is in attempt to bridge the digital divide and create equal opportunity that enables elevation of socio-economic development for the target community. However, existing ICT4D studies show that sustainability of ICT-enabled development proves to be a challenge for a number of impoverished countries that undertake this form of investment. This is because, in most cases, the socio-economic development objectives that are designed to benefit the developing community are never realised in practice upon implementation of an ICT4D initiative. The sustainability failure of ICT4D interventions threatens the availability of already limited resources that could have been alternatively invested to benefit the community.

Sustainability of ICT4D interventions in developing countries continues to be a subject of interest for ICT4D researchers, sponsors of ICT4D, as well as other stakeholders (including subject developing communities). Gunnstam and Nordquist (2009) state that the sustainability of ICT4D initiatives is perceived to be an input towards social and economic development. However, on the contrary, the lack of sustainability in ICT4D

initiatives creates uncertainty in developing communities, due to the lack of stability that is needed to realise the intended outcome of improving people's lives socially and economically through ICT (Heeks, 2010b).

The failure of ICT4D initiatives in developing countries has been attributed to a large number of related and unrelated dimensions within the context of the intended developing community. The scope of this thesis focusses on the common fundamental factors and interactions that are perceived in literature as enablers and disablers of sustainability in ICT4D. Sustainability in ICT4D is not a definitive concept, as an unknown number of factors and interactions unique to the context of application influences the success or failure of ICT4D implementations and the sustainability thereof. This is why researchers perceive sustainability in ICT4D differently (Avgerou, 2008).

The understanding of critical elements that constitute sustainability in ICT4D could help developing countries to accomplish their envisioned socio-economic development objectives. In addition, when these elements are identified, a more informed list of enablers and disablers of sustainability in ICT4D projects can be provided to aid in decreasing resource wastage, by effective and efficient implementation of ICTs. The purpose is the consistent realisation of the intended socio-economic benefit for the target community.

1.6 RESEARCH QUESTIONS

1.6.1 Main Research Question

The main question for this study is as follows:

i. What are the factors that influence and/or impact sustainability in ICT4D according to selected ICT4D literature?

1.6.2 Sub Research Questions

The sub research questions for this study include the following:

i. How is sustainability in ICT4D perceived?
ii. What are the factors that influence sustainability in ICT4D according to the literature?

iii. How does sustainability in ICT4D affect socio-economic development in the context of developing communities?

iv. For each study on ICT4D interventions, how do the selected definitions and assumptions of sustainability compare to how the outcome is described?

1.7 RESEARCH METHODOLOGY

This research is conducted by means of a SLR to identify and understand the factors and interactions that influence sustainability in ICT4D. The literature review reflects the characteristics of an interpretive paradigm (Oates, 2006), as it intends to gather knowledge that is based on existing contributions related to the subject or topic being studied. Furthermore, a literature review is a scholarly article that is informed by the existing body of knowledge, with supported or proven findings through theoretical and methodological process, to substantiate the topic under study. The data utilised in a literature review is termed secondary data, because it generally does not present new findings, but is rather a collection of facts to explain the phenomenon. The study's research methodology is discussed further in Chapter 2 of this dissertation.

1.8 ASSUMPTIONS AND LIMITATIONS

1.8.1 Assumptions

The researcher assumes that all relevant data, which are collated from the chosen academic journals, are credible. Therefore, for this research to present accurate findings, emphasis is placed on the credibility of the cited sources. Secondly, the researcher assumes that the scholarly journals and conference proceedings, from which the data were collected, publish quality articles that have not been compromised in any manner that would misrepresent the findings of this study.

1.8.2 Limitations

The research only focussed on ICT4D and ICT4D sustainability studies published in credible ICT4D journals, including conference proceedings. A significant number of studies that focus on sustainability in ICT4D have been published. However, due to the time limitations associated with a study for the purpose of obtaining a Master's Degree in Information Technology (Information Systems), the researcher only focussed on studies published between 2005 and 2018.

1.9 BRIEF CHAPTER OVERVIEW

A brief overview of each chapter in this study is presented below.

1.9.1 Chapter 2: Research Methodology

Chapter 2 of the study explains the methodology followed by the researcher to conduct the study. The chapter begins by identifying and discussing the research philosophy that inspires the means of interpreting the phenomena. In parallel to the research philosophy, Chapter 2 also outlines the research approach. Furthermore, the research strategy is presented, along with data collection and analysis methods.

1.9.2 Chapter 3: Descriptive Statistics

Chapter 3 of this dissertation presents an analysis of the attributes of the data set of 40 chosen articles. The chapter is intended to analyse and summarise statistics that quantitatively describe various attributes of the 40 articles.

1.9.3 Chapter 4: Discussion of Search Results

The perceptions of sustainability in ICT4D are explored and discussed, based on the reflections presented in studies relating to sustainability in ICT4D. These studies have been published in various academic ICT4D journals and conference proceedings. The purpose of this chapter is to provide a baseline of various literature interpretations of the phenomena under investigation, so as to identify and understand aspects that are perceived to represent sustainability in ICT4D interventions.

1.9.4 Chapter 5: Analysis of Findings

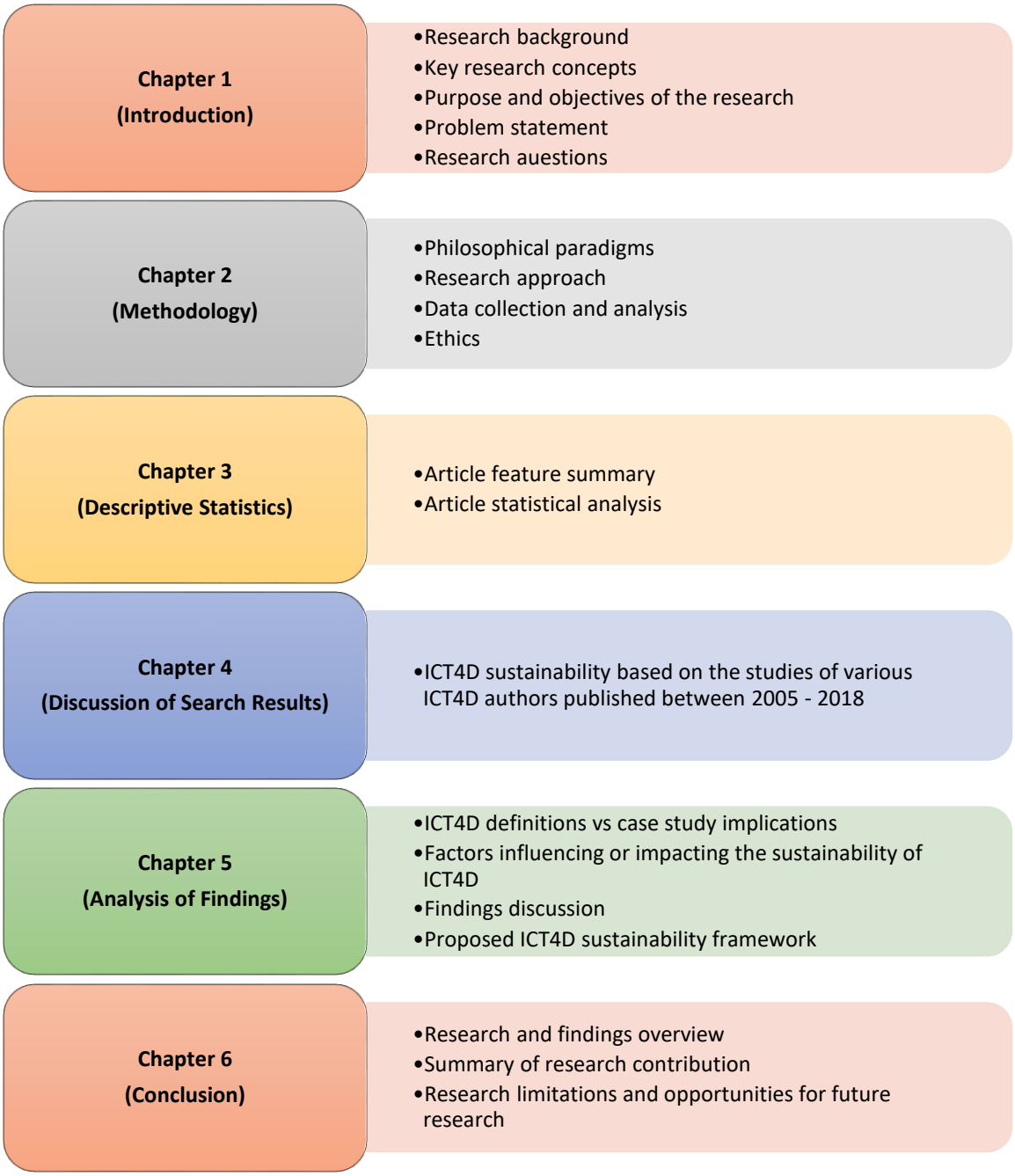
Chapter 5 highlights established common perceptions of sustainability in ICT4D, based on arguments presented in various reviewed phenomena studies. These contemplated and qualified views provide the necessary foundation in response to the research questions. Critical factors and interactions that are perceived as enablers and disablers of sustainability in ICT4D are extracted from the reviewed literature and outlined in this chapter. Chapter 5 also proposes a framework within which ICT4D stakeholders can holistically interpret the phenomena. This proposed ICT4D sustainability framework is

aimed at creating awareness that will lead to informed decision making by accountable and responsible stakeholders when implementing ICT4D initiatives.

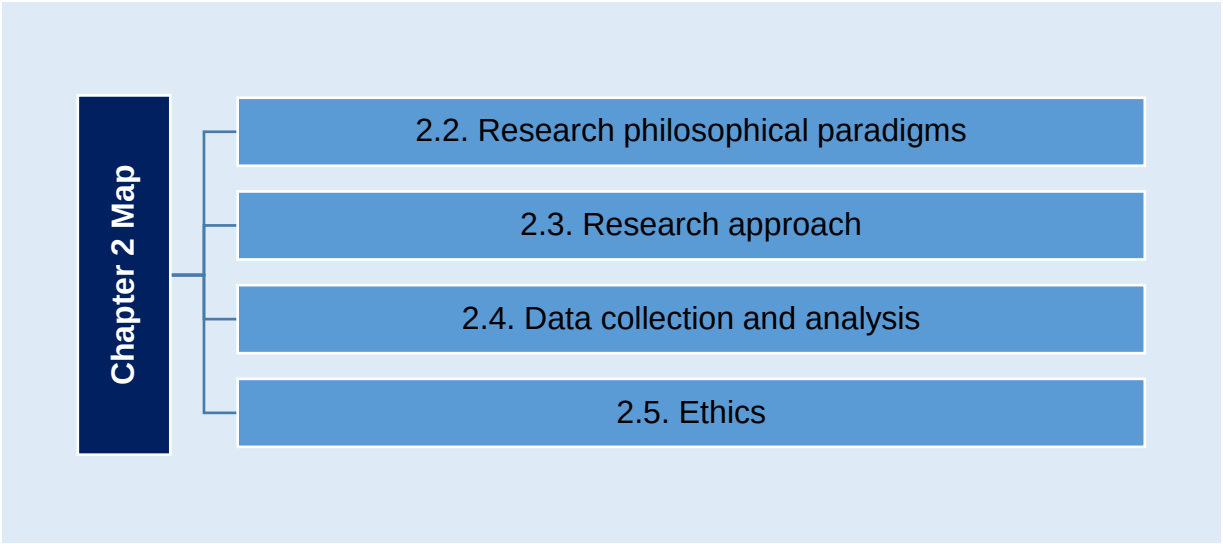
1.9.5 Chapter 6: Research Conclusion

In Chapter 6, the researcher concludes the study by summarising the content and purpose of this document. Key points presented in the body of this research paper are reiterated briefly as a reminder to the reader, with refreshed and deeper understanding of the phenomena. This chapter does not add any new knowledge to the study, as its purpose is to summarise discovered knowledge. Chapter 6 is concluded by stressing the significance of the research findings and outcomes in relation to the phenomena under study as well as the ICT4D discipline, and makes recommendations for future research.

1.10 THESIS MAP



2 METHODOLOGY



2.1 INTRODUCTION

Chapter 2 of this dissertation presents the research approach. This includes a discussion of the research philosophy, research methodology, as well as the data gathering and analysis techniques used to uncover knowledge related to the phenomena under investigation in existing ICT4D studies.

2.2 PHILOSOPHICAL RESEARCH PARADIGMS

A paradigm is a shared theoretical system of belief that represents the manner in which knowledge related to a particular phenomenon should be understood (Kuhn, 1962). Research paradigms independently view reality (ontology) differently, and prescribe unique techniques to acquire the relevant knowledge (epistemology) to support the existence of reality (Guba, 1990). Three research paradigms are considered to be dominant in Information Systems (IS) research, namely, the positivist, interpretive, and critical research paradigms (Lincoln & Guba, 1994; Oates, 2006; Kuechler & Vaishnavi, 2012).

According to Oates (2006), the positivist paradigm considers reality from a scientific perspective. It uses statistical methods to prove or disprove proposed hypotheses. Research conducted under the positivist paradigm aims to achieve research outcomes that are objectively based on presented facts that support the existence of a single,

measurable reality. Quantitative methods (such as sampling, statistical analysis, questionnaires, and interviews) can be used to articulate the truth about ontology in a positivist paradigm.

Terre Blanche & Durrheim (1999) and Oates (2006) state that the interpretive paradigm is subjective as it attempts to understand the reasoning behind certain outcomes or occurrences in the context of reality. The interpretive paradigm uses qualitative methods such as observations, case studies, and interviews to acknowledge and consider perceptions about phenomena from multiple realities. The aim is to establish meaning and understanding that is based on various encountered experiences.

Critical research is described by Oates (2006) as research that is conducted in a social context. This paradigm aims to contest existing political, cultural, and power relations within a social context. Researchers that make use of the critical research paradigm are driven by ethical considerations and therefore intend not only to describe and explain observable social settings, but also aspire to improve circumstances in order to establish equity (e.g., economic or social equity) within poor and marginalised communities. Table 2.1 below summarises the main benefits and critiques of each philosophical paradigm.

Table 2.1: Philosophical paradigm benefits and critiques

Positivist
Benefits • Makes use of a quantitative (scientific method) approach that leverages data and analysis as a basis for formulating findings (Scotland, 2012). • Limited error rate as it follows a well-defined structure that leads to more accurate results by making use of objective mathematical and scientific tools and following specific rules (Orlikowski & Baroudi, 1991). **Critiques** • It is restrictive and inflexible because it does not accommodate the validity of other research paradigms and creative theories that cannot be measured (Scotland, 2012).

- It does not accommodate human behaviour/emotions as it is restricted to objective views as opposed to those that appear to be subjective.

Interpretive

Benefits

- It accommodates diversified views, which enables researchers to not only describe objects, human or events, but allows them to be deeply understood from their social context (Orlikowski & Baroudi, 1991).
- It leverages interactive methods that allow interpretive researchers to investigate abstract contextual characteristics, by probing interviewee's thoughts, values, prejudices, perceptions, views, feelings and perspectives (Scotland, 2012).

Critiques

- The research outcome often leaves gaps that requires a further scientific approach to verify the validity and usefulness of the outcome or findings.
- This research paradigm focusses on subjective views expressed through the researcher's own interpretations, belief system, and way of thinking which can create bias as opposed to applying an objective approach.

Critical Research

Benefits

- Attempts to critically evaluate and transform the contextual social reality that is subject to investigation instead of explaining or predicting nature of social relations (Hirschheim & Klein, 1989).
- Critical research interrogates values and assumptions, to uncover social injustice and challenge conventional social structures in order to engage in social action that brings about change (Orlikowski & Baroudi, 1991).

Critiques

- This is paradigm is considered to have a deliberate political agenda rather than remaining objective, dispassionate, and disinterested.
- Critical theorists often do not have clarity in relation to the guidelines and plans to achieve the desired outcomes (Scotland, 2012).

Given the intentions of this study, the researcher makes use of the interpretive paradigm to identify and understand elements and interactions perceived to enable sustainability in ICT4D interventions within poor and marginalised societies. The interpretive paradigm is selected because it allows the researcher to analyse and translate the context of reality, based on unique experiences, into a subjectively chosen generalised view that expresses a subjective attempt to holistically understand the phenomenon.

2.3 RESEARCH APPROACH

The author makes use of the interpretive research paradigm to identify and understand factors perceived to enable and/or disable sustainability in ICT4D interventions. Walsham (1993) defines the interpretive paradigm as a method whereby researchers relate to “reality” based on people’s subjective understanding of their external environment. Reality is therefore viewed as socially constructive, based on people’s encounters or interactions with a particular phenomenon (ICT4D in this case) (Walsham, 1993).

The qualitative research approach highlights the socially constructed nature of reality. This approach focuses on capturing, analysing, and uncovering the true meaning of human behaviour from various contextual viewpoints, which may present similar or contradictory interpretations of the experience of phenomena (Gregor, 2006).

Through the use of the qualitative approach, the researcher aims to gain a rich understanding of the knowledge of the elements and interactions that facilitate sustainability in ICT4D. The purpose is to develop a framework that depicts sustainability elements in ICT4D initiatives based on existing research, and to extend this cited knowledge (through a combination of text and visual representations). This will allow ICT4D stakeholders to develop a collective understanding of the meaning of the sustainability of ICT-enabled development.

2.4 RESEARCH STRATEGY

This study makes use of a systematic literature review (SLR) process to organise and prioritise knowledge related to sustainability in ICT4D implementations, based on the

SLR guidelines recommended by Petticrew and Roberts (2006) as well as Okoli and Schabram (2010). According to Petticrew and Roberts (2006), an SLR process is considered to be a scientific tool that involves the interpretation of rich knowledge in order to gain insight into the published material related to a particular research topic. Similarly, Okoli and Schabram (2010) state that an SLR process entails a robust process of analysing the knowledge under investigation to fully comprehend its meaning.

Chalmers (2003) and Oakley (2002) views the SLR process as an analytical process for substantively investigating known published knowledge about a particular research topic. The SLR process is considered to have the potential to eliminate possible distortion caused by biases in some research. Therefore, the SLR process has the potential to present reliable research findings through text and graphical representations (framework) that depict an understanding of the knowledge of selected phenomena (Petticrew & Roberts, 2006; Okoli & Schabram, 2010).

A SLR does not intend to generalise knowledge, but rather emphasises context, subject, and period (Sandelowski & Barroso, 2007). The drivers of this research study is the desire to comprehensively verify and present perceptions of sustainability in ICT4D pertaining to communities in the developing world, and the SLR process is applied to studies published during the period 2005-2018. Although the SLR process can be used to synthesise both qualitative and quantitative studies, studies with a qualitative research design were selected for review (see Chapter 4). This study therefore employs an SLR process of a qualitative nature, using an interpretive approach.

The researcher made use of information published in leading ICT4D journals and ICT4D conference proceedings. This information was analysed in depth to formulate the findings presented by this study in relation to the perceptions of sustainability in ICT4D within developing communities. The SLR process was undertaken using the guidelines recommended by Petticrew and Roberts (2006) as well as Okoli and Schabram (2010).

2.4.1 Summary of the SLR

This study uses the SLR process to establish common views presented in ICT4D literature relating to the phenomena. According to Petticrew and Roberts (2006), a systematic review can be categorised as a survey-based study, as it aims to verify known knowledge in response to the research question(s). Therefore, the information that is sourced and analysed in the review process has to be specific and closely related to the phenomena being investigated.

Figure 2.1a summarises the different stages of the SLR process that was followed by the researcher to gather and summarise academic articles that contributed to this study. A detailed discussion of each SLR stage is presented later in this chapter. The representation shows selected academic databases (ICT4D journals and ICT4D conference proceedings) and the corresponding number of articles retrieved. These chosen academic sources were used to search for articles related to ICT4D and sustainability using the selected key words, as depicted in Figure 2.1a. The key words provided the basis for sourcing general articles related to this study. However, through the review process, emphasis was placed on articles related to the sustainability, success, and failure of ICT4D implementations. Characteristics of each stage are articulated in the succeeding paragraphs as a means of fully describing the SLR process.

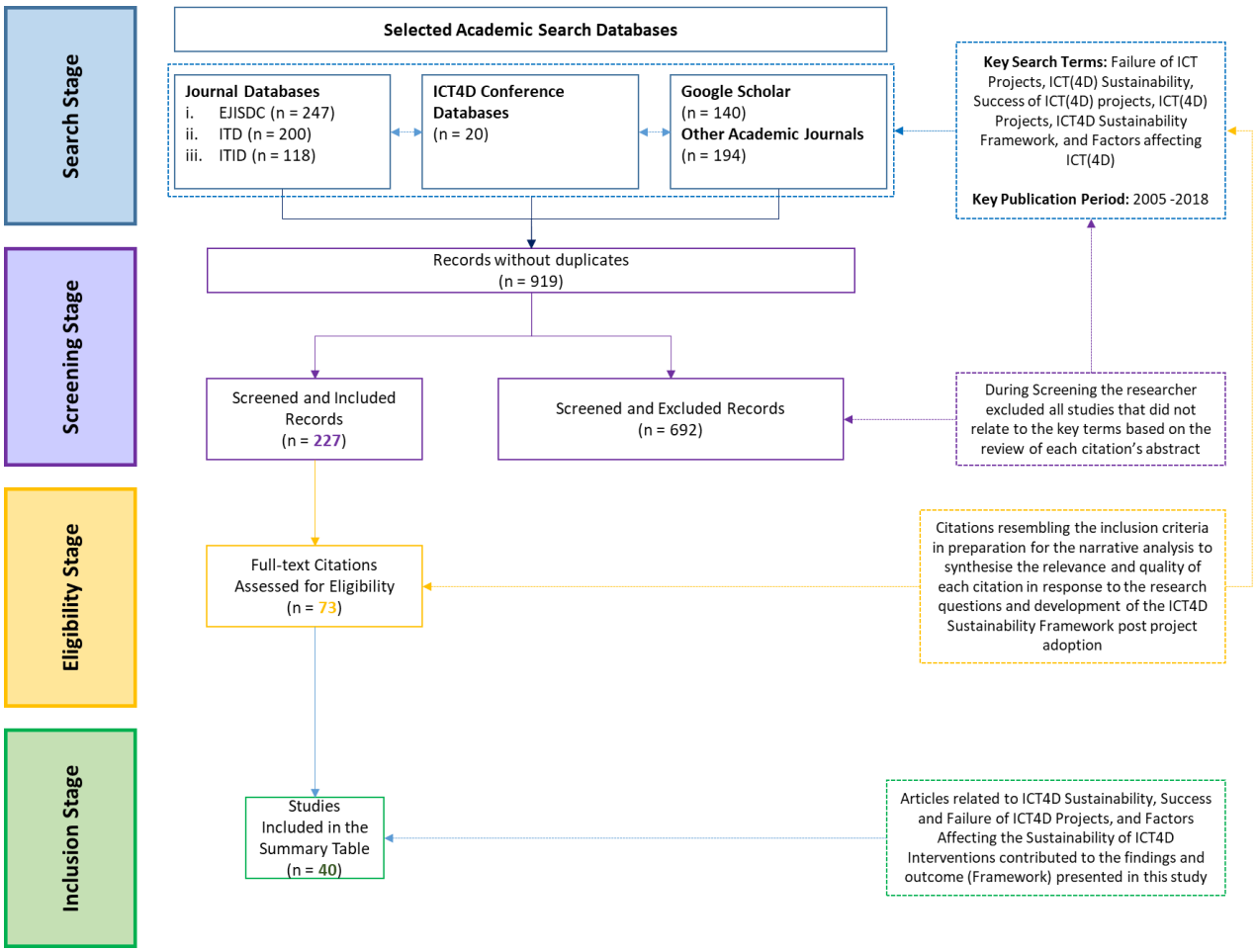
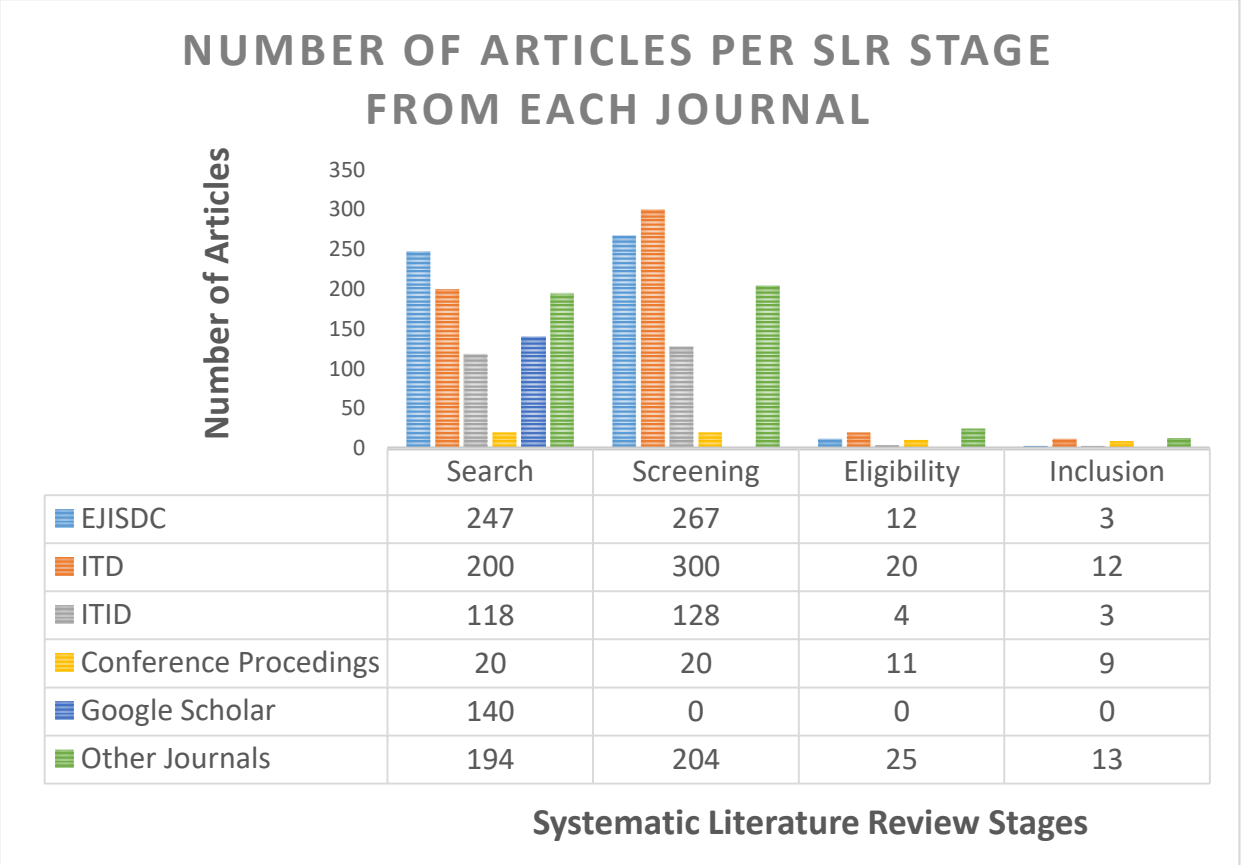


Figure 2.1(a): *SLR Stages, Sources, and Key Words*



	Search	Screening	Eligibility	Inclusion
EJISDC	247	267	12	3
ITD	200	300	20	12
ITID	118	128	4	3
Conference Procedings	20	20	11	9
Google Scholar	140	0	0	0
Other Journals	194	204	25	13

***Figure 2.1(b)**: Number of Articles per Stage of the Systematic Review per Journal*

The SLR process required the researcher to set out a protocol for sources consulted and key words used. This enabled the researcher to filter out information that was deemed irrelevant, not supported by strong evidence but rather by assumptions, biased, or that was not considered to be of an academic nature (lacked necessary presentation and referencing). Systematic reviews are considered to be a tedious process that involves perusing and contemplating various articles to inform the research objective. A well-executed systematic review distils information to resemble the precise understanding that is contextually fundamental to the phenomena (Petticrew & Roberts, 2006; Okoli & Schabram, 2010).

To illustrate the understanding of the knowledge of the cited phenomena (40 articles included in the study), an artefact in the form of a framework is presented as the main outcome of this research. This framework is intended to act as a guide that advocates for sustainability in ICT-enabled development in poor and marginalised communities, and as such allowing for informed decision making by officials and other stakeholders involved in the implementation of ICT4D. This is done in attempt to achieve the

continuous socio-economic benefit realisation that improves local livelihoods by making use of ICT.

2.4.2 Scope and Reliability of Reviewed Studies

According to Petticrew and Roberts (2006), the scope of studies to be reviewed is determined by their contribution towards answering the research question(s). This entails that the researcher focusses on articles that are closely related to the intervention being interpreted. However, the quality of the evidence supporting the chosen studies plays a significant role in selecting studies that are not compromised by subjective views, but that are rather supported and informed by facts pertaining to experiences of phenomena. Additionally, Okoli and Schabram (2010) state that the scoping process involves the selection of relevant articles, and ensuring that these articles are characterised by quality content, based on the authenticity and credibility of their source.

When conducted appropriately, systematic reviews have the potential to produce accurate findings of knowledge related to the phenomena under investigation (Stansfield, Thomas, & Brunton et al, 2012). Therefore, the process of article selection should be thoroughly carried out to identify those studies that are necessary to ensure an accurate research outcome. The latter should be characterised by objectivity and facts gathered through a scientific process. Although the SLR process is also characterised by challenges such as high or low data volumes, time constraints, and subscriptions that prevent access to articles, it is important to formulate a scope that is sufficiently manageable to ensure reliability and accuracy of findings, leading to the proposed research outcome (Stansfield, Thomas, & Brunton et al, 2012).

This study made use of specific ICT4D academic studies published in established ICT4D journals and conference proceedings between the years 2005 and 2018, so as to gain a reliable understanding of the phenomenon. Knowledge gathered and integrated through this review process were used as building blocks towards the proposed ICT4D sustainability framework presented in Chapter 5. To ensure the credibility of the proposed framework, the reviewed studies were selected based on

their relevance to the topic, credibility of the source journal or conference publication, and the integrity of the accompanied evidence.

Moreover, during the article selection process, the researcher prioritised studies that were conducted between the years 2005 to 2018. This prioritisation was done to ensure the applicability of the studies to the current social, economic, political, environmental, and technological atmosphere in the context of developing communities, and hence to present findings that are relatable to modern day situational needs, considering their changing nature. Further, prioritising studies that were conducted during the stated period proved to be a practical way of managing the workload, and to ensure completion of the research within the time allocated by the University of Pretoria for the researcher's enrolled qualification.

The main research question and sub research questions, guided by the objectives of the proposed research framework, were the main drivers in the selection of published articles. Chosen studies needed to reflect the properties pertaining to the research questions. In other words, this study focussed on publications of studies related to ICT4D, failure and success factors of ICT4D, and sustainability in ICT4D, that were sourced and rigorously reviewed and analysed to validate and justify the research findings and outcome.

2.4.3 Data Collection and Analysis

Okoli and Schabram (2010) mention that the inclusion criteria for studies influence the search strategy for relevant studies. Online academic journal databases specific to the discipline served as an ideal source of articles on the phenomena under investigation. The database searches presented the researcher with an article overview in which it was possible to see each study's topic, abstract summary, and publication source. This brief information made it easier for the researcher to determine the relevance of the studies, without having to open and scan through the entire body of each article.

However, a single journal database may not represent a complete view of required articles that are relevant to the research question(s) and the planned research outcome. Therefore, several academic journal and conference databases, as depicted

in Figure 2.1(a), were used to extend the search to retrieve more studies on sustainability in ICT4D.

Petticrew and Roberts (2006) state that the key words used in a search serve to access relevant articles in the selected academic journal and conference databases. These key words were derived from the research topic (see Figure 2.1(a)), and were aimed at narrowing the search process so as to ensure that the search results would largely produce anticipated studies pertaining to the intervention under investigation. Thereby, it would allow for the retrieval of substantial information that is required for the review. The search did not use geography as a criteria for selection or exclusion of articles. The only consideration was the inclusion of studies conducted in developing countries around the world, including areas such as Africa and Asia.

For this study, the researcher focussed on the three top-ranked ICT4D journals identified by Heeks (2010), namely:

- The Electronic Journal of Information Systems in Developing countries (EJISDC);
- Information Technology for Development (ITD); and
- Information Technology and International Development (ITID).

Heeks ranks these three journals as the leading journals in the ICT4D discipline, based on the number of ICT4D publications as well as the average number of citations and number of article downloads (Heeks, 2010). The three selected journals comprise peer-reviewed articles to increase the quality of work. The journals were used as the main sources of information, and were searched using the keywords presented in in Figure 2.1(a).

The website of each of the three journals contains a search box, where the researcher was able to input key words such “ICT, ICT4D, Framework, Sustainability, Success, and Failure” to search for articles in the overall databases for the period 2005-2018. To ensure that the search was comprehensive, different versions (synonyms such as support, barriers, model, and challenges) of these terms were used in conjunction with the term “ICT4D”. The academic journal databases allowed a search for similar words by placing an asterisk at the end of each key word — for example “Success*” — to identify related articles.

The researcher also searched using a combination of key terms, including “Failure of ICT(4D), sustainability in ICT(4D), success of ICT(4D), ICT(4D), ICT(4D) sustainability framework, and factors affecting ICT(4D)". This, search strategy produced a significant number of studies, which had to be reviewed for their applicability to this study. This was considered as a favourable method for sourcing relevant studies, given that it was specific to the types of articles required. The number of articles that were found per searched academic journal is indicated in Figure 2.1(b) of Section 2.4.1. The articles produced in the search stage followed a process of validation to determine their relevance to this study. This means that not all studies produced during the search stage contributed to this study’s findings, as illustrated in Figure 2.1(a) and 2.1(b) of Section 2.4.1. Only 40 articles were in the end selected from hundreds of searched articles.

The following figures (Figures 2.2 to 2.4) reflect the different journal search pages that were used to source studies. These search pages are characterised by a similar filtering function that returns possible applicable articles after each search was conducted. The structure of each search site is explained by the following key:

Journal Search Page Structure Key

	Publication period for searched studies
	The name of the searched academic journal
	Search box, used to input key words/terms

The journal search pages in Figures 2.2 to 2.5 enabled the researcher to search for relevant studies, and to quickly distinguish between relevant and irrelevant studies. As a result, the researcher could focus his time on an in-depth review and analysis of the content of the relevant studies, based on the selection criteria, to develop an applicable response to the research questions.

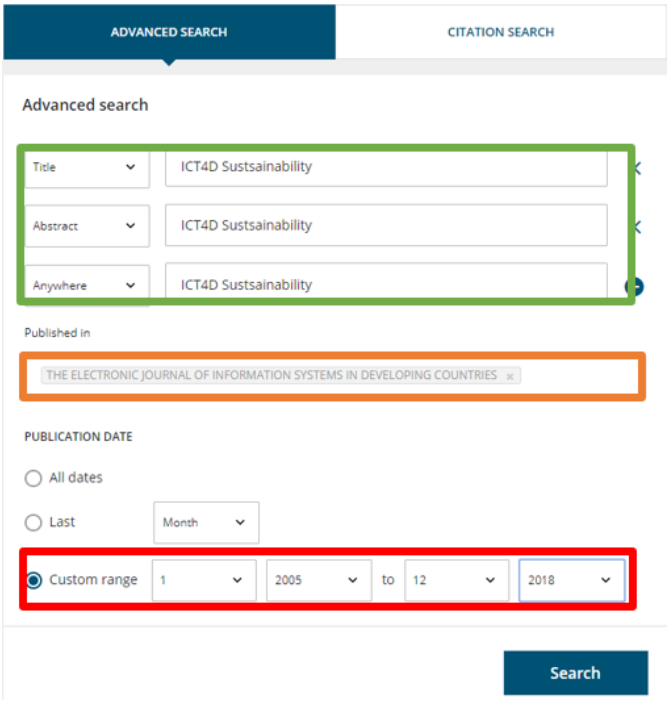


Figure 2.2: *EJISDC Journal Search Page*

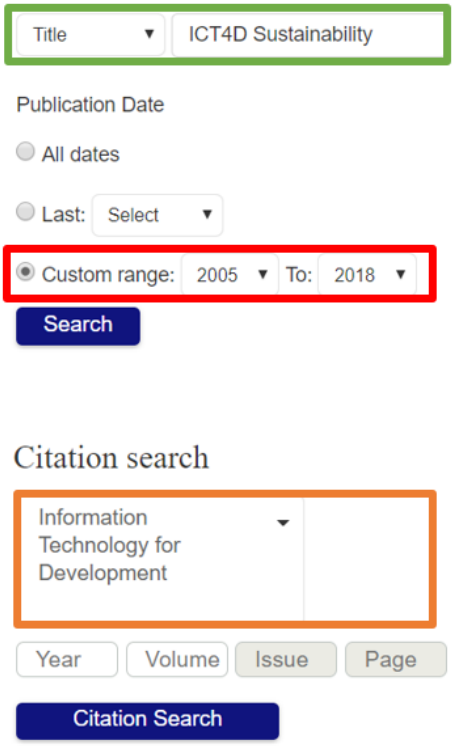


Figure 2.3*: ITD Journal Search Page*

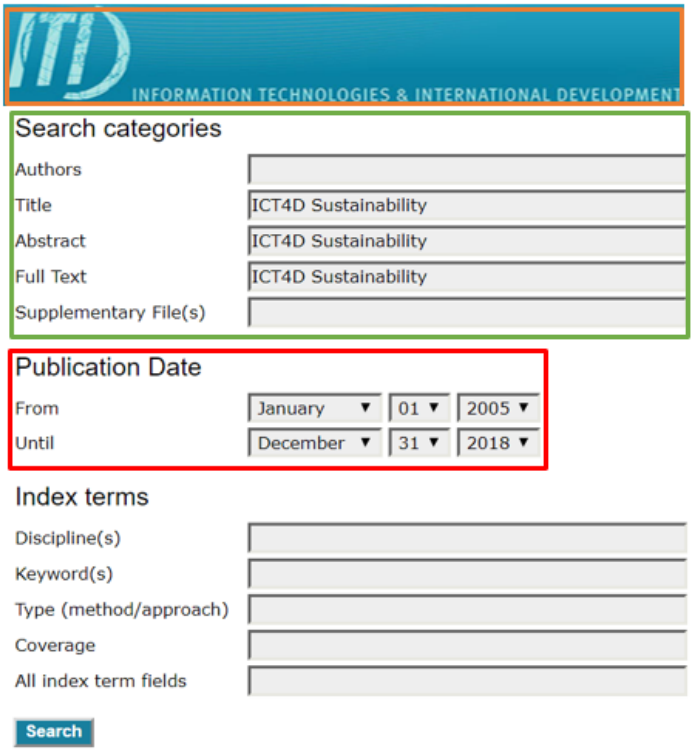


Figure 2.4: *ITID Journal Search Page*

The search strategy that was employed in the journal search process was also undertaken to identify applicable studies from known ICT4D conference proceedings, including but not limited to the following:

- International Conference on Information and Communication Technologies and Development (ICTD); and
- International Conference of IFIP Working Group 9.4 (IFIP WG 9.4).

Google Scholar was also used by researcher to search for more relevant studies — this time not limited to the three chosen journals, but including ICT4D journals such as IEEE Xplore Digital Library and Information Systems Journal. A combination of search terms were used to source articles within the custom date range (2005-2018). Each search on Google Scholar resulted in thousands of articles, most of which were irrelevant, while others were duplicates from the previous searches. The researcher therefore navigated only through the search results of the first four Google Scholar results pages.

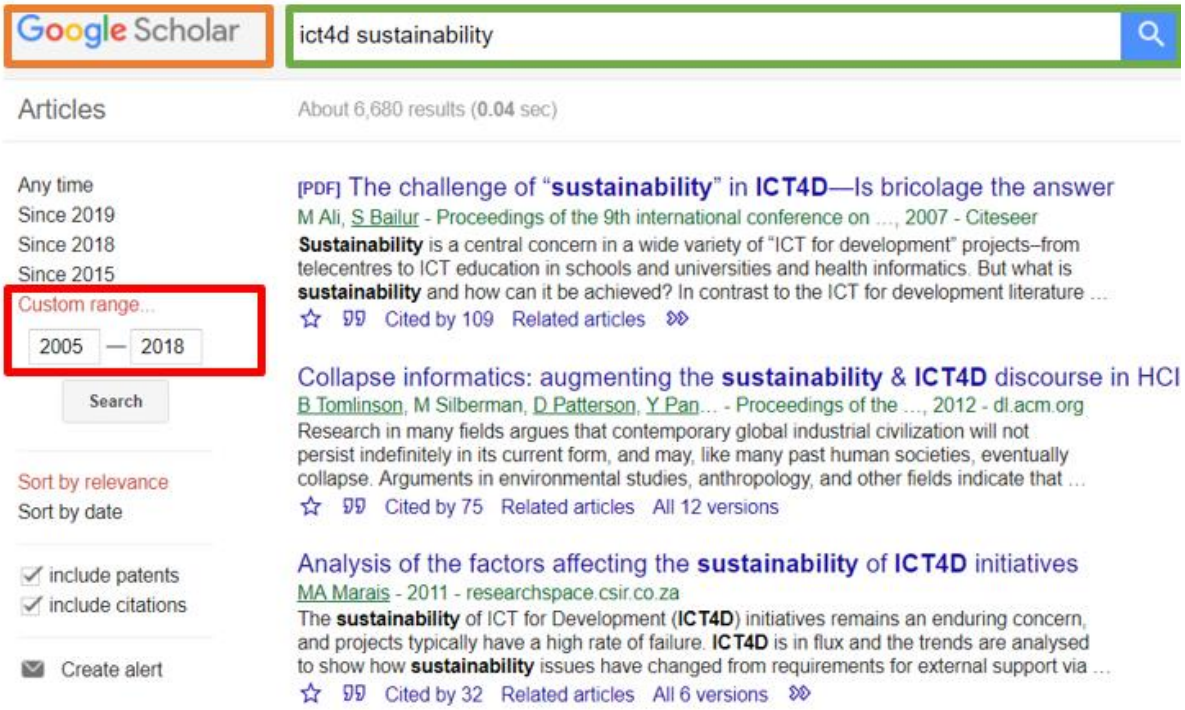


Figure 2.5: *Google Scholar Search Page*

2.4.4 Article Screening and Coding Process

All articles identified during the search process were screened by the researcher to identify those that were relevant. The researcher assessed the title, and then examined the abstract to determine the applicability of each study. The screening process was based on inclusion criteria that emphasised articles that closely or fully informed the research question(s) and shaped the characteristics of the research outcome.

Though a lengthy manual process, the screening process promoted an objective application of the article selection process. The researcher focussed on the feasibility and impact of prospective articles, based on an analysis of their title and abstract. The significance of the article's title is that it captured the attention of the researcher, thus allowing him to relate and assume the relevance of the article by recognising key words and control terms in the title.

The abstract of each study confirmed the inclusion or exclusion of the article. Content included in the abstract of each article needed to relate to or reflect an objective discussion on sustainability in ICT4D within a developing society, based on acquired evidence illustrated in each study. Therefore, the abstract of each article was mostly

used and relied upon to gain an understanding of the scope and purpose of each study, in order to qualify relevance and justify the article's selection based on its fit for purpose to this dissertation.

After finalising the screening process and identification of all applicable studies, the adequacy of information "fit for the purpose" of this research needed to be extracted from the selected studies. Known as "coding", this process involved extraction of useful information that describes the characteristics of the selected studies relative to the research question(s) presented in Chapter 1, and on the basis of the inclusion criteria. Furthermore, to determine the quality of each prospective study, the coding process allowed the researcher to analyse and contemplate the method(s) used in each searched study, and to consider the validity of the study's supporting evidence for the research questions of this study (Thomas, McNaught, & Ananiadou, 2011).

The findings of each reviewed study were assessed and synthesised to address the research question(s), and to partly inform the development of the research outcome — which, in the case of this research, is a framework that aims to create awareness within the context of a developing community regarding the perceptions of sustainability in ICT4D. The purpose of the framework is to enable the implementers of ICT4D interventions to engage in informed decision making that does not compromise the realisation of sustained benefit for local livelihoods, but that focus on enabling ICT4D initiatives that promote sustained benefit realisation for improved socio-economic equality in poor and marginalised communities.

The combination of the screening and coding processes led to the identification of further studies from the references section of each chosen study. The references section of each reviewed article provided the researcher with a full view of the sources consulted for each study. This provided a basis for more potential studies to be identified and reviewed, based on the guidelines set in the inclusion criteria as well as on awareness of the research questions. Therefore, the relevant studies identified in the bibliography section of each selected study were then sourced and reviewed to gain an improved understanding into their applicability to this study, using the SLR screening and coding process as discussed in this chapter.

2.4.5 Appraising the Quality and Relevance of Chosen Articles

The appraising stage is needed to critically examine each chosen article to determine where and how it can be interpreted with respect to the phenomena, in comparison with other citations. During this stage of the research methodology, the researcher can identify potential bias within individual studies (if any), as these may negatively impact the research outcome (Petticrew & Roberts, 2006; Okoli & Schabram, 2010).

Gough (2007) proposes three criteria for the appraisal of articles to ensure relevance and quality of each study, depending on presented evidence. These are: interpreting each citation's relevance to the research question(s); the appropriateness of the study's methods in the context of the phenomena being investigated; and, lastly, determining the execution quality of the methods thereof.

The applicability of each article to the research question(s) is the first component. Some reviewed studies may match the inclusion criteria but may become less relevant due to certain elements of the study design when compared to other selected studies. Therefore, the dismissal of these previously selected studies during the appraisal stage can be due to a number of characteristics, including sample features, nature of the intervention, or data collection methods. The second part of the appraisal stage reflects on the appropriateness of the research design and methods ("fit for purpose") in addressing the research question(s). The last component determines the successful execution of each study, evaluated through presented quality criteria (Gough, 2007).

Together, these three criteria are used to determine the quality of reviewed citations (Gough, 2007). This has an effect on the quality of the findings and the outcome of studies that utilise this methodology (such as this one). Therefore, the quality of each of the reviewed articles that contributed towards the synthesised findings and outcome of this thesis was assessed by considering the three appraisal criteria in combination.

2.4.6 Synthesising Referenced Articles

The synthesis process involves integrating the findings of relevant reviewed studies in response to the research question(s). This entails probing available data, observing existing patterns or similarities between the data, and understanding the collective

meaning of the examined data. It is this collective interpretation that is used to definitively inform the review questions (Petticrew & Roberts, 2006; Okoli & Schabram, 2010).

To ensure a fair generic view of selected literature, the researcher used Microsoft Excel Programme to conduct a simple narrative analysis. The latter is described by Petticrew and Roberts (2006) as a text analysis that summarises and explains the findings of various studies that fully or partly share common views regarding factors or elements that affect the phenomena. This is done in response to the research question(s) of the study being carried out.

A narrative analysis consists of three steps that simplify the process of interpreting and synthesising chosen citations. The initial step involves organising the description of the citation into logical categories. The second step entails that the reviewer analyses the findings of each category of studies. Lastly, the third step aims to synthesise the findings across all included studies (Petticrew & Roberts, 2006; Okoli & Schabram, 2010).

In Chapter 5 (analysis of findings), the researcher organises and presents selected articles for analysis in a tabular form using Microsoft Excel. Studies were organised sequentially based on their year of publication and intended contribution towards the phenomena body of knowledge. This organisation makes it easy for the researcher to identify possible useful studies, and to eliminate those studies that are not aligned to the purpose of this dissertation in each year of the period under consideration.

The tabular structure is intended to identify and categorise common study findings that provide indication of what sustainability in ICT4D entails. This is done in order to answer the review question(s), and also to enable development of a framework that will illustrate the perceptions of sustainability in ICT4D. This framework is intended to help ICT4D implementers to make informed decisions that will lead to sustained benefit realisation when undertaking ICT4D implementations, so as to promote socio-economic development in the global developing community.

The selected studies' findings were categorised as either enabling or disabling. These categories of study findings enabled the researcher to examine common data and to identify patterns that are relevant to interpreting the intervention, based on known knowledge that shares a common view and that is derived from different study contexts. Table 2.2 provides a structural representation that depicts the manner in which the selected studies were presented and summarised for ease of interpretation of the intervention.

Table 2.2: Structure used to Summarise Citation Findings and their Key Points

Analysis of Article Findings				
#	Article Author(s)	Chapter 3 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabling/Disabling Factor
1				
2				
3				

Finally, data summarised in the table were compared (cross synthesised) in order to find common meaning as well as differences. The extracted information was then used as a basis for responding to the research questions, and acted as a foundation for developing the framework that illustrates the perceptions of sustainability in ICT4D.

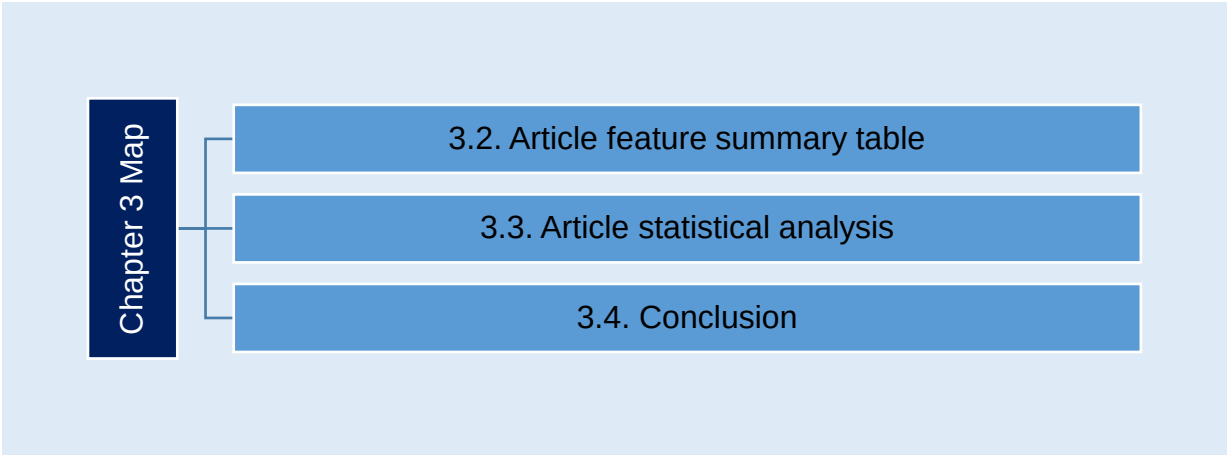
2.5 ETHICS

This research is conducted using the SLR process. All chosen articles that contributed to the research findings and outcome are of an academic nature. The researcher made use of articles published in established ICT4D journals and conference proceedings and performed a Google Scholar search to source more academic articles. The SLR process was conducted in the manner described above, in order to ensure the quality and integrity of each chosen article. This study was guided by specific inclusion criteria in order to ensure consistency; only studies that were deemed relevant to contribute towards this dissertation, as detailed in the research strategy (Section 2.4) of this chapter, were accommodated. Although, this study does not involve the gathering of empirical data directly from any personnel, a research clearance was requested by the researcher on the university's student portal and approval was granted to undertake this study by the research committee.

2.6 CONCLUSION

Chapter 2 explains the philosophy, research strategy, and data gathering and analysis techniques used by this study that led to the proposed findings and outcome. In summary, this chapter illustrates the procedures followed by the researcher to realise the findings and proposed framework (which represents the outcome artefact) as presented and discussed in Chapter 5 of this study. This chapter also presents a tabular structure that was used as an analysis tool to categorise and understand relevant studies.

3 DESCRIPTIVE STATISTICS



3.1 INTRODUCTION

Application of the methodology explained in Chapter 2 resulted in the identification of 40 articles that are directly relevant to this research. The findings from the analyses of these articles are discussed in the next two chapters. This chapter quantitatively summarises the features that describe the SLR process as well as the selected data set of the chosen 40 articles. The quantitative summarisation is presented in table format, stipulating the collective feature unit occurrence within the 40 articles. Furthermore, each table of features is complemented by a figure that graphically illustrates the percentage share of each analysed feature.

3.2 SUMMARY OF ARTICLE FEATURES

Table 3.1 summarises the features of the 40 selected articles. The features relate to the journal of publication, geographical area (continent and country) where the study was conducted, as well as information pertaining to the methodology incorporated by each chosen study, with emphasis on research philosophy, research design, and research instrument. Articles are summarised in chronological order.

Table 3.1: Summary of Article Features

#	Reference	Source	Continent of Study	Country of Study	Research Philosophy	Research Design	Research Instrument
1	Kumar (2005)	ITID	Asia	India	Interpretive	case study	observations and interviews
2	Kimaro and Nhampossa (2005)	ITD	Africa	Tanzania and Mozambique	critical research	case study	interviews
3	Krishna and Walsham (2005)	ITD	Asia	India	interpretive	case study	interviews
4	Jacucci, Shaw, and Braa (2006)	ITD	Africa	South Africa	interpretive	case study	interviews, observations, and document analysis
5	Kumar and Best (2006)	The Information Society	Asia	India	interpretive and positivist	case study	document analysis and surveys
6	Kuriyan, Toyama, and Ray (2006)	Proceedings of the 2006 International Conference on Information and Communications Technologies and Development	Asia	India	interpretive	case study	interviews and observations
7	Ali and Bailur (2007)	Proceedings of the 9th International Conference on Social Implications of Computers in Developing Countries	Asia	India and Saudi Arabia	interpretive	case study	interviews
8	Grunfeld (2007)	CPRsouth2 Conference, Chennai, India, December 15-17, 2007 Empowering rural communities through ICT policy and research	Australia and Asia	Cape York Australia and Timor Leste	interpretive	case study	interviews, observations, and surveys

#	Reference	Source	Continent of Study	Country of Study	Research Philosophy	Research Design	Research Instrument
9	Gerhan and Mutula (2007)	ITD	Africa	Botswana	interpretive	case study	document analysis and observation
10	Hosman and Fife (2008)	International Journal of Media and Cultural Politics	Asia	Sri Lanka	interpretive	case study	observation and interviews
11	Best and Kumar (2008)	ITID	Asia	India	interpretive and positivist	case study	survey and interviews
12	Silivus, Van Den Brink, and Smit (2009)	Communications of the IIMA	None	None	interpretive	systematic literature review	document analysis and telephonic interview
13	Pade, Mallinson, and Sewry (2009)	ISD	Africa	South Africa	interpretive	case study	document analysis
14	Bailey (2009)	EJISDC	The Caribbean	Jamaica	interpretive	case study	interviews
15	Brunello (2010)	ITD	None	None	interpretive	systematic literature review	document analysis
16	van Rensburg, Cronje, and du Buisson (2010)	CSIR 3rd Beinnual Conference 2010	Africa	South Africa	interpretive	case study	interviews and observations
17	Marais (2011)	IDIA2011 Conference Proceedings	Africa	South Africa	interpretive	case study	document analysis
18	Hosman (2011)	ITD	Asia	Sri Lanka	interpretive	case study	interviews, observations, surveys, and interactions
19	Vaughan (2011)	EIT	Australia	Cape York Australia	interpretive	case study	interviews, observations, and document analysis
20	Pade-Khene, Mallinson, and Sewry (2011)	ITD	Africa	South Africa	interpretive	case study	interviews, observations, and document analysis
21	Masiero (2011)	EJISDC	Asia	India	interpretive	case study	interviews and observations
22	Mashinini and Lotriet (2011)	International Journal of African Renaissance	Africa	South Africa	interpretive	case study	interviews

#	Reference	Source	Continent of Study	Country of Study	Research Philosophy	Research Design	Research Instrument
		Studies Multi-, Inter- and Transdisciplinarity					
23	Servaes, Polk, Shi, Reilly and Yakupitijage (2012)	Development in Practice	Africa and Asia	Sierra Leone and India	interpretive	case study	interviews, observations, surveys, and interactions
24	Madikiza (2012)	Development Southern Africa	None	None	interpretive	case study	document
25	De Zoysa and Letch (2013)	Proceedings of the Nineteenth Americas Conference on Information Systems, Chicago	Asia	Not Stated	interpretive	case study	interviews, document analysis, and evaluation
26	Nawi, Shukor, Basaruddin, Omar, Rahman, Hassan, and Hassan (2013)	IJCSI	Asia	Malaysia	interpretive	case study	document analysis, observation, survey and interviews
27	Kisan, Dadabhau, and Singh (2013)	Agri. Reviews	Asia	India	interpretive	systematic literature review	document analysis
28	Breytenbach, De Villiers, and Jordaan (2013)	ITD	Africa	South Africa	interpretive and positivist	case study	interviews and observations
29	Sanner and Sæbø (2014)	ITID	Africa	Malawi	interpretive	case study	observation and interviews
30	Marais (2015)	CSIR	Africa	South Africa	interpretive	systematic literature review	document analysis
31	Ochara and Mawela (2015)	ITD	Africa	South Africa	positivist	case study	survey based (questionnaire)
32	Tanner and du Toit (2015)	EJISDC	Africa	South Africa	interpretive	case study	observation and document analysis

#	Reference	Source	Continent of Study	Country of Study	Research Philosophy	Research Design	Research Instrument
33	Lennerfors, Fors, and van Rooijen (2015)	ITP	None	None	interpretive	systematic literature review	document analysis
34	Manara and Gelderblom (2016)	IST-Africa 2016 Conference Proceedings	Africa	South Africa	interpretive	case study	questionnaires and interviews
35	da Silva and Fernández (2016)	2016 49th Hawaii International Conference on System Sciences	None	None	interpretive	systematic literature review	document analysis
36	Sigweni, Mangwala, and Azerikat (2017)	IEEE Africon 2017 Proceedings	Africa	Ghana	interpretive	case study	observations
37	Hosman and Armey (2017)	ITD	Asia, Africa, Europe, South and North America	None	interpretive and positivist	multi-methods	interviews and surveys
38	Mthoko and Khene (2018)	ITD	None	None	interpretive	systematic literature review	document analysis
39	Meurer, Muller, Simone, Wagner, and Volker (2018)	JCC	None	None	interpretive	systematic literature review	document analysis
40	Barclay, Donalds, and Osei-Bryson (2018)	ITD	The Caribbean	Jamaica	positivist	case study	survey-based (questionnaire)

3.3 STATISTICAL ANALYSIS OF ARTICLES

3.3.1 Summary of Sources

The 40 selected articles represent the foundation for understanding the phenomena under investigation. These studies were selected as a result of a search process that was guided by specific inclusion and exclusion criteria, as discussed in Section “2.4.1” of Chapter 2. Three academic journals and two conference proceedings were used as the primary information sources. In addition, searches on conducted on Google Scholar produced further relevant articles from secondary journals, which are referred to in Table 3.2 as “Other Journals”. Specific control terms were used to narrow the search and produce more applicable articles in relation to the objectives of this study. All studies that were identified through the search process were then screened to eliminate duplicate and irrelevant articles. The entire SLR process resulted in 40 articles from a variety of sources that were deemed relevant to this study, as depicted in Table 3.1. Table 3.2 summarises the distribution of articles across sources, and indicates that the majority of the articles were sourced from the ITD journal; this is also illustrated in Figure 3.1.

Table 3.2: Article source representation

Source	Article Representation
ITD	12
Conference Proceedings	9
EJISDC	3
ITID	3
Other Journals	13
Total Number of Articles	**40**

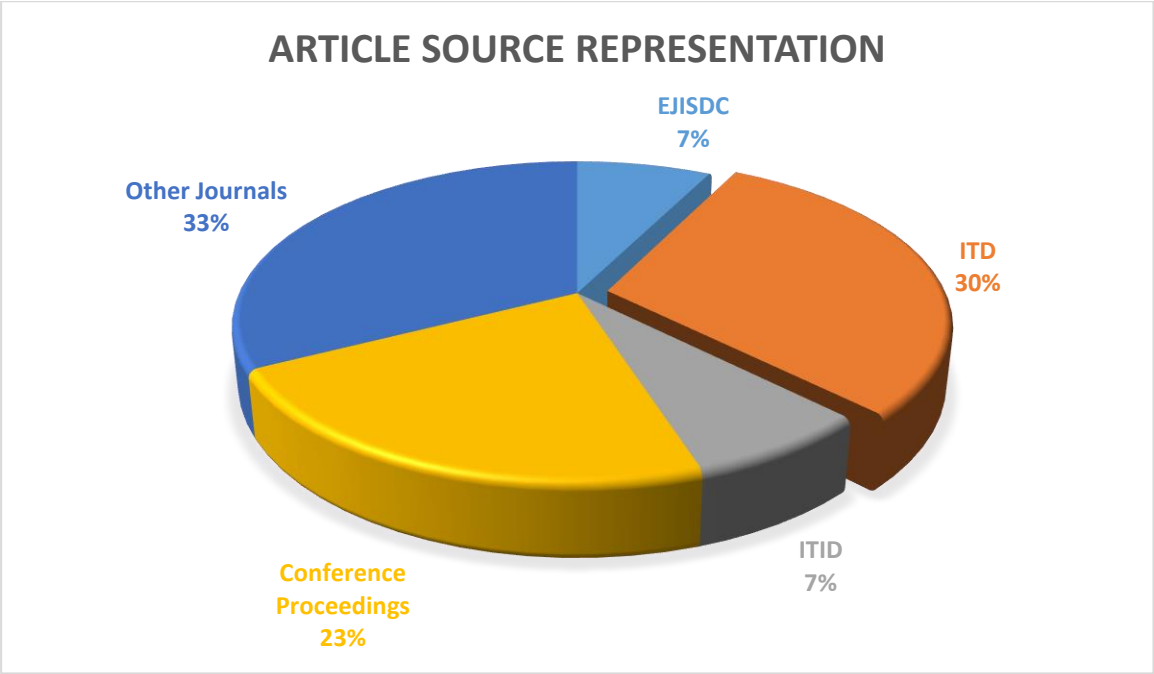


Figure 3.1: *Article Source Representation*

3.3.2 Philosophical Paradigms

Data related to article paradigms employed in the chosen 40 articles indicate that majority of the studies made use of the interpretive paradigm. This paradigm is concerned with understanding the target community's subjective experiences in relation to the phenomenon being investigated. Some studies combined the interpretive paradigm with the positivist paradigm in order to validate their subjective understanding of local people experiences with scientific methods. The most represented research philosophical paradigm within the 40 selected studies was the interpretive paradigm, followed by the positivist paradigm, and lastly the critical research paradigm as can be seen in Table 3.3 and Figure 3.2.

Table 3.3: Article research paradigm representation

Research Paradigm	Article Representation
Interpretive	35
Positivist	4
Critical Research	1
Total Number of Articles	**40**

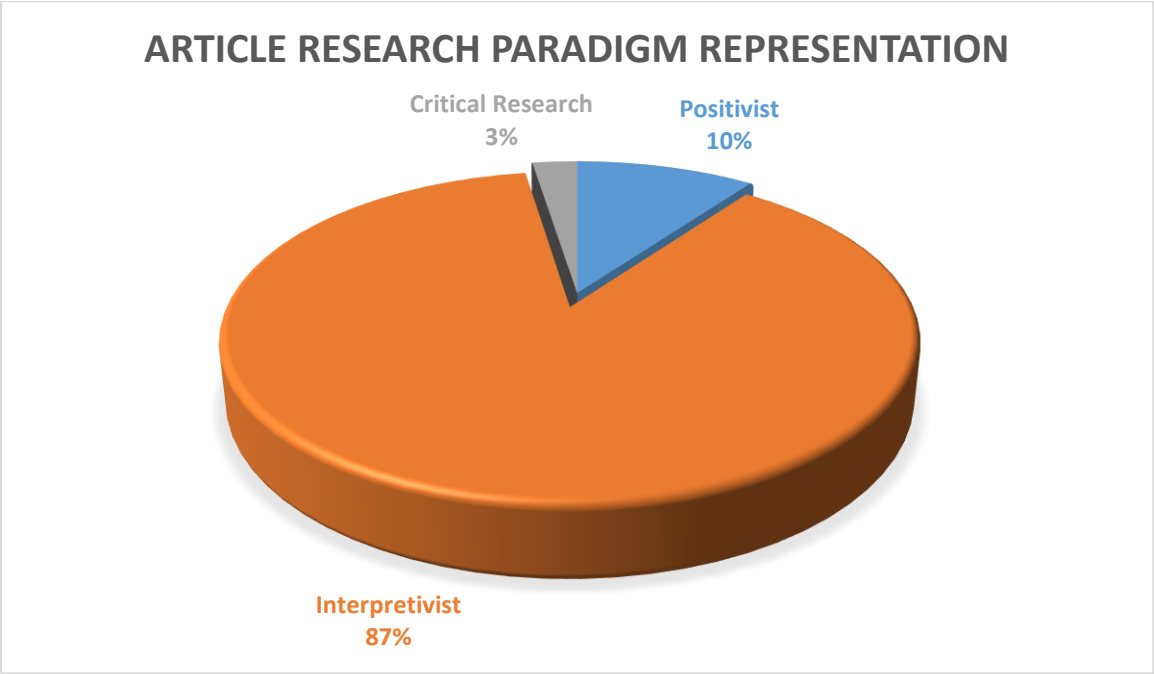


Figure 3.2: *Article Research Paradigm Representation*

3.3.3 Research Designs

The case study research design, which is associated with the interpretive research paradigm by Oates (2006), was dominant in the selected articles. Oats (2006) states that a case study allows the researcher to gain insight into the nature of the world (ontology), and to understand the reasoning behind certain events (epistemology) related to a certain context of the environment under investigation. Table 3.4 and Figure 3.3 outline the distribution of research designs across the selected articles, indicating that case study was the dominant design (77% of articles).

Table 3.4: Article research design representation

Study Design	Article Representation
Case Study	31
Systematic Literature Reviews	8
Mixed Research Design	1
Total Number of Articles	**40**

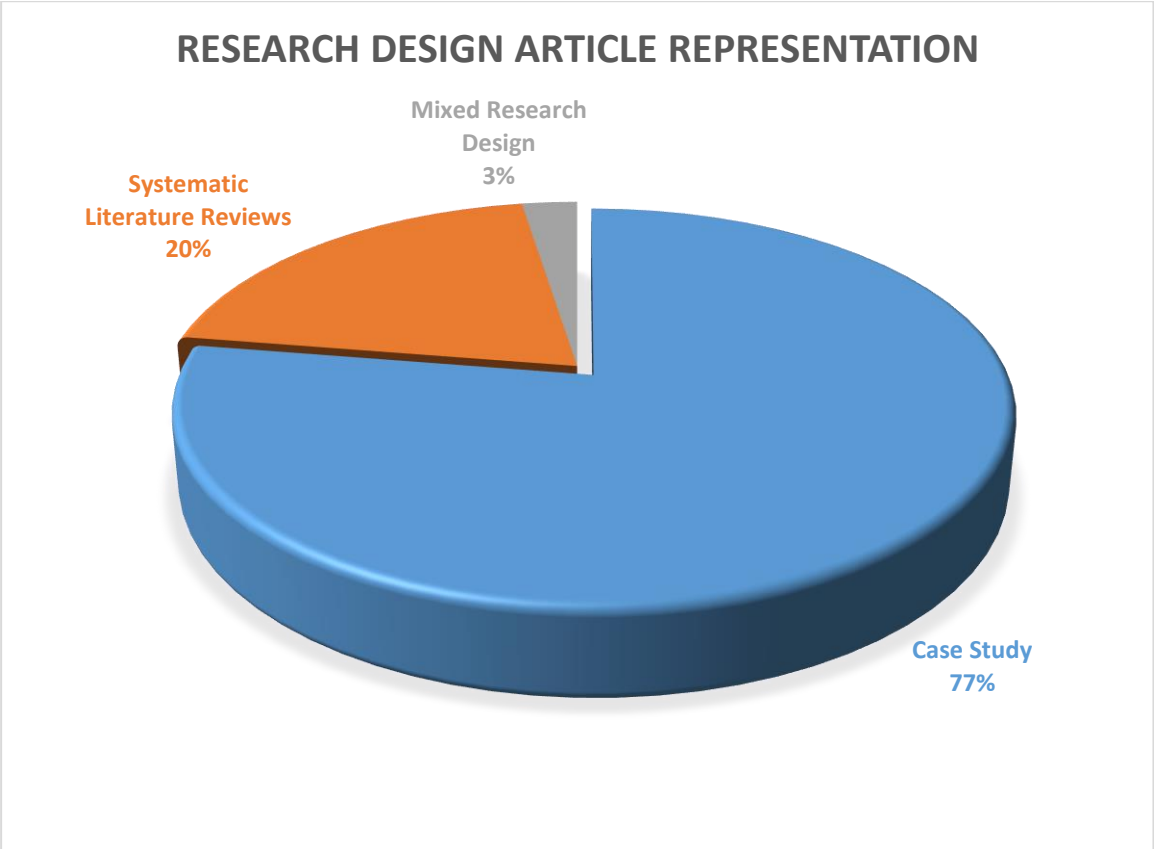


Figure 3.3: *Article Research Design Representation*

3.3.4 Research Instruments

Four major data collection methods were used across the selected studies, with document analysis being the preferred instrument, as indicated in Table 3.5 and Figure 3.4. Some studies made use of a collection of research instruments to gather a wide variety of sufficient data, depending on their study context, while others only made use of one instrument to collect data. However, the data shows that document analysis was the leading and favourable data collection instrument, followed by interviews, then observations, and lastly surveys. Although most articles used a case study as their preferred study design, it was noted that a document analysis was used to complement other instruments such including observations, surveys, and interviews. A score of one was granted to research instrument that was independently used by a study. The following equation was used to determine the research instrument's representation within an article.

$$Research\ Instrument\ Article\ Representation = \frac{1}{Number\ of\ Used\ Research\ Instruments}$$

Table 3.5: Article research instrument representation

Research Instrument	Article Representation
Document Analysis	14.2
Interviews	12.8
Observations	7.6
Surveys (questionnaire)	5.4
Total Number of Articles	**40**

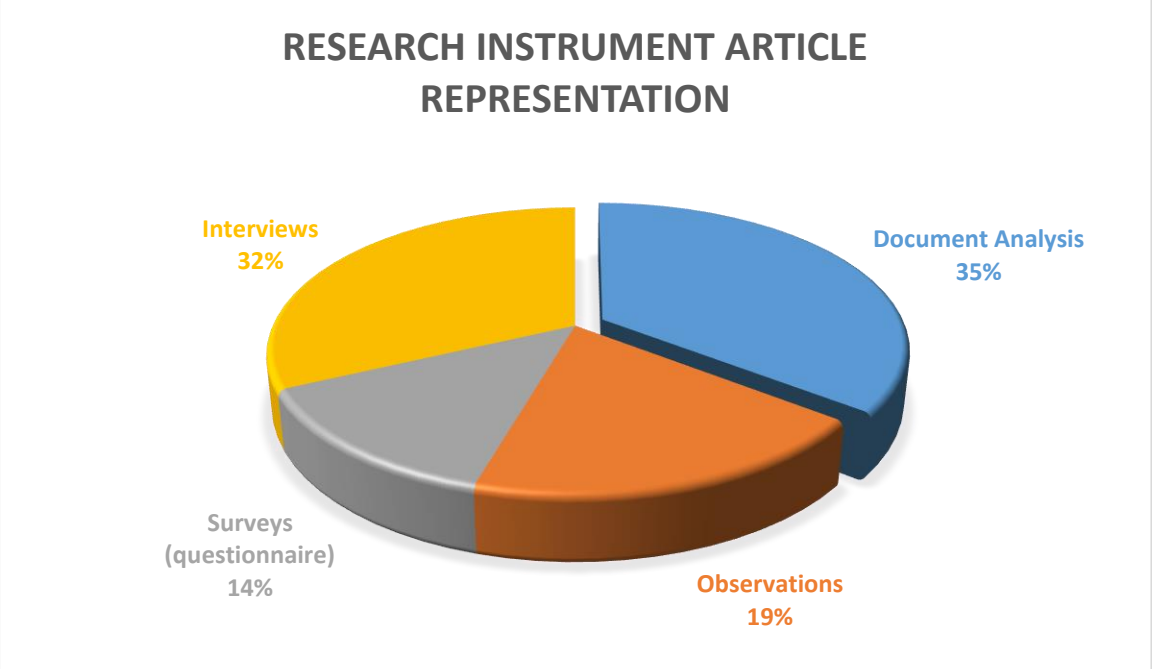


Figure 3.4: *Article Research Instrument Representation*

3.3.5 Developing Regions and Countries

The majority of the selected articles reported on studies that were carried out in Africa, with the second most in Asia, as can be seen in Table 3.6 and Figure 3.5. The countries of origin of each study are summarised in Table 3.7 and Figure 3.6, indicating that South Africa is the most represented country. Further analysis was undertaken to assess the representation of the different continents and countries in the selected papers. Fully represented continents each had an article that solely focussed on the specific continent; a score of 1 was granted to this continent. For those continents that were partially represented in an article (meaning that multiple case studies were undertaken in different continents), a distributed scoring was used, based on the number of continents present in one study (see Table 3.6). Similarly, a score of one was granted to a region or country that was independently focussed on by a study (see

Table 3.7). The following equation was used to determine the region and country's representation within one article.

$$Region/Country\ Article\ Representation = \frac{1}{Number\ of\ Used\ Region(s)\ or\ Country(s)}$$

Table 3.6: Article continent representation

Name of Continent	Article Representation
Africa	15.7
Asia	13.2
None	7
The Caribbean	2
Australia	1.5
Europe	0.2
South America	0.2
North America	0.2
Total Number of Articles	**40**

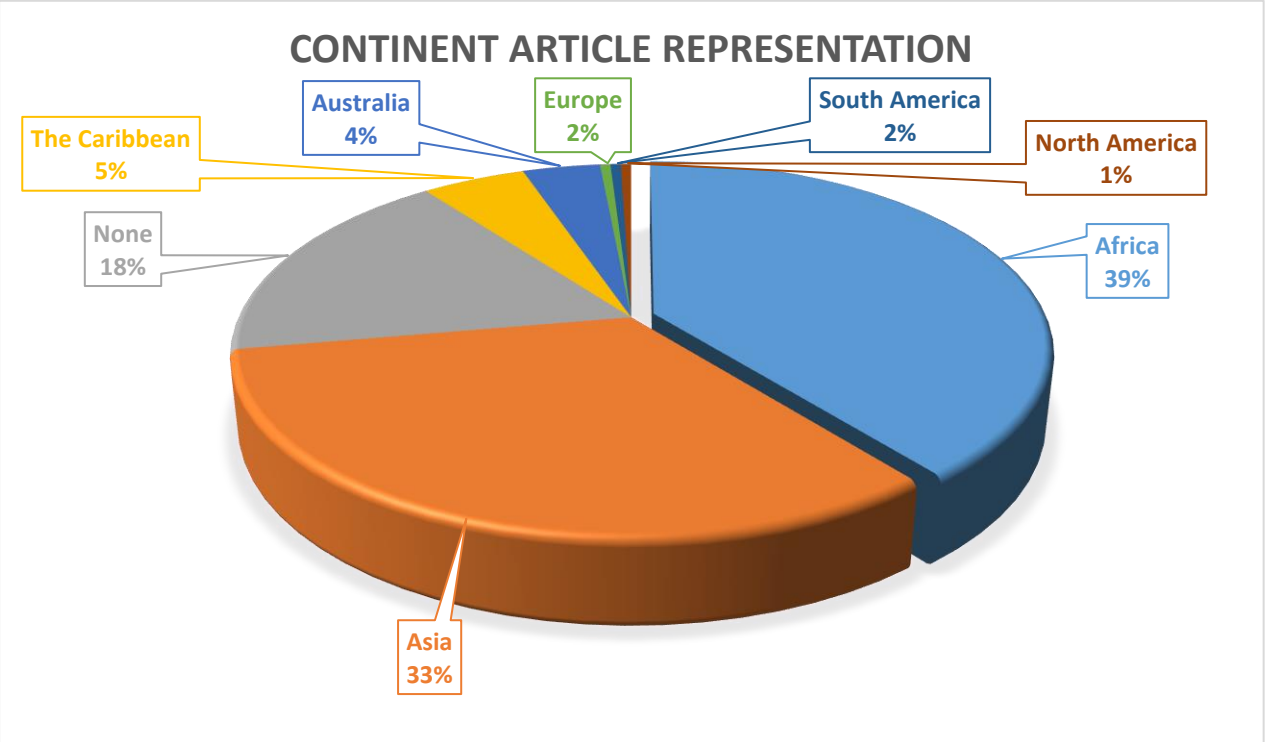


Figure 3.5: *Article Continent Representation*

Table 3.7: Article country representation

Name of Country	Article Representation
South Africa	11
None	9
India	8
Jamaica	2
Sri Lanka	2
Cape York Australia	1.5
Botswana	1
Ghana	1
Malawi	1
Malaysia	1
Mozambique	0.5
Saudi Arabia	0.5
Sierra Leone	0.5
Tanzania	0.5
Timor Leste	0.5
Total Number of Articles	**40**

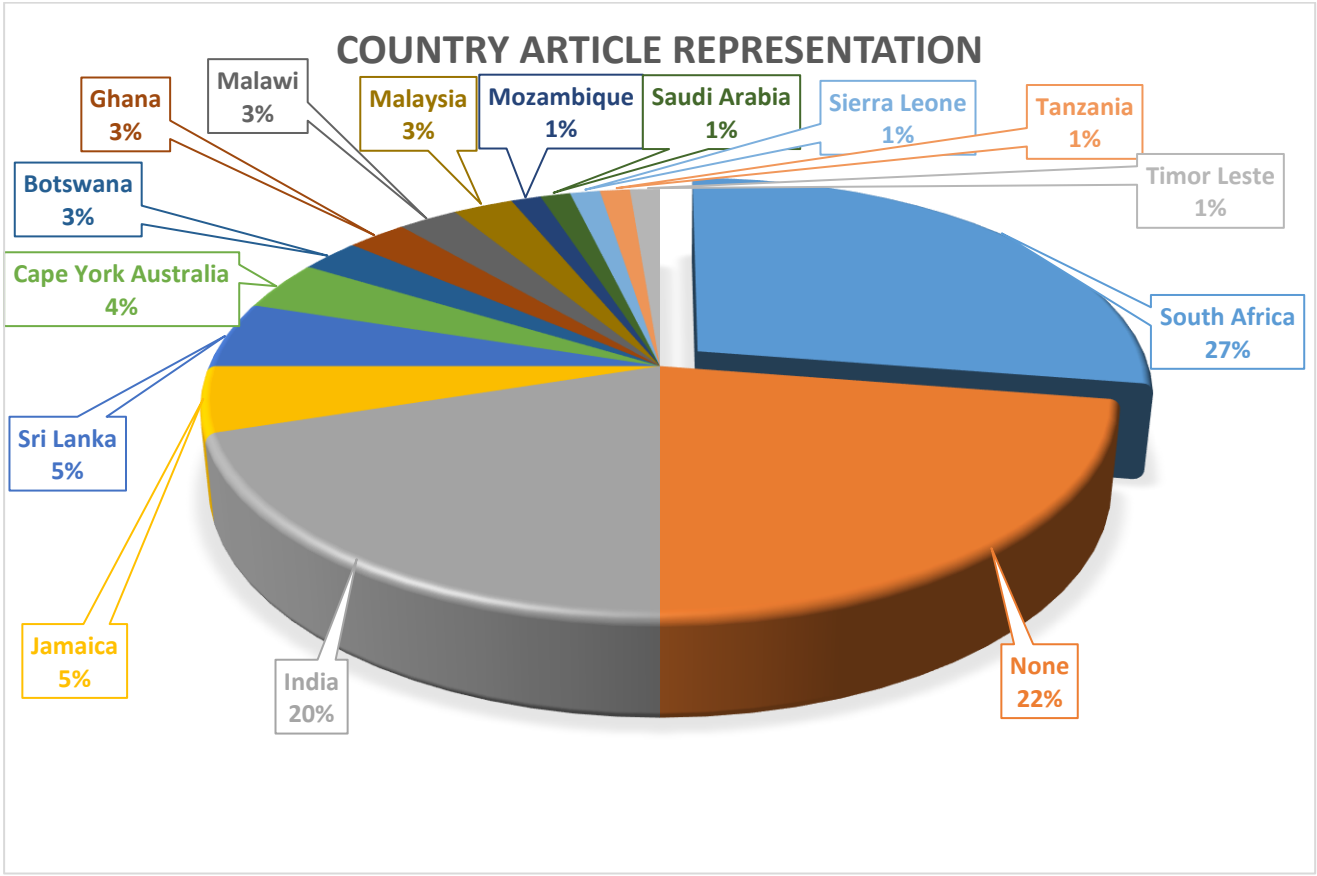


Figure 3.6: *Article Country Representation*

3.3.6 Year of Publication

The search focussed on articles that were published between 2005 and 2018. This was selected as an in-scope period, as discussed under the study's limitations in Section 1.8.2. Table 3.8 and Figure 3.7 presents the number of articles in each year of the in-scope period.

Table 3.8: Articles publication year representation

Article Year	Article Representation
2005	3
2006	3
2007	3
2008	2
2009	3
2010	2
2011	6
2012	2
2013	4
2014	1
2015	4
2016	2
2017	2
2018	3
Total Number of Articles	**40**

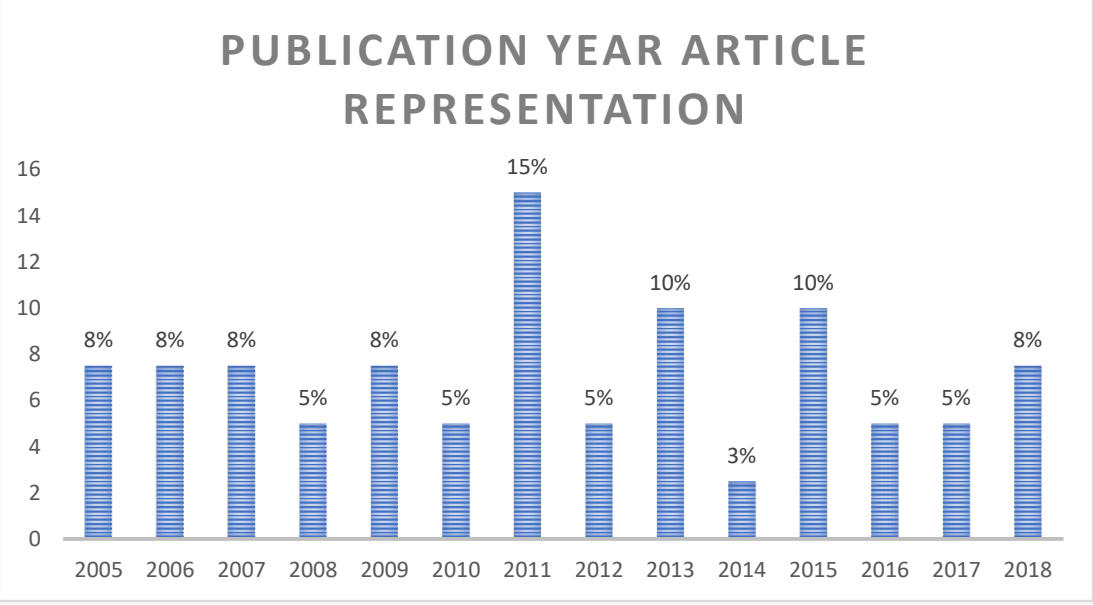
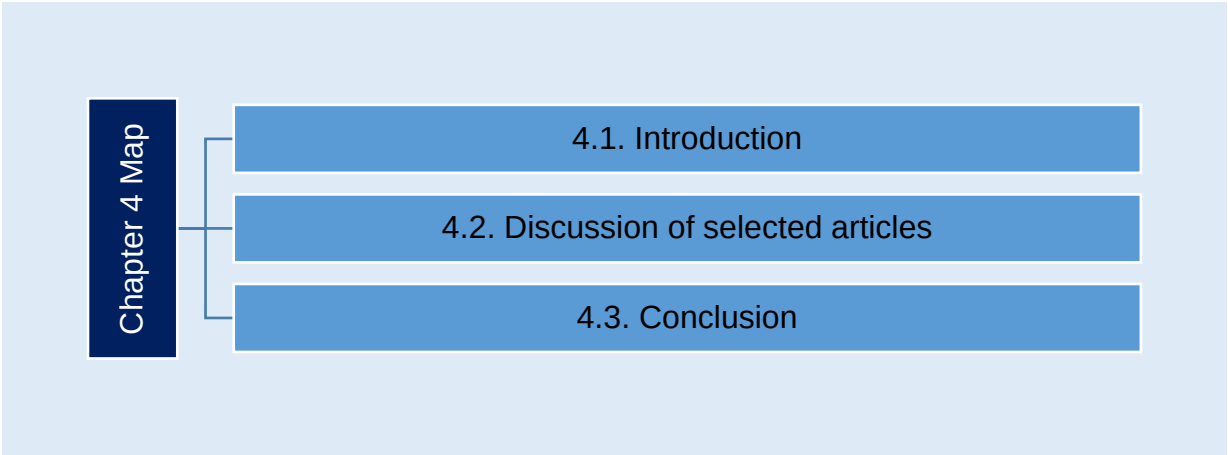


Figure 3.7: *Publication Year Article Representation*

3.4 CONCLUSION

This chapter discussed the characteristics of the selected studies, and presented an analysis of data that describes the 40 articles in a meaningful manner by identifying patterns and potential relations between the articles. The 40 articles were identified by using the SLR process stipulated in Figure 2.1(a), and described in Chapter 2. The feature analysis performed in this chapter indicates that the 40 chosen articles were largely sourced from the ITD, EJISDC, and ITID journals, with the remainder of the articles being sourced from a variety of other ICT4D journals, including ICT4D conference proceedings. The scope of the entire selection of articles was focussed on ICT4D initiatives and their sustainability within poor and marginalised communities around the world, with the majority focusing on communities in Africa and Asia. This confirms that these chosen articles conform to the objectives and purpose of this research. The next chapter presents a detailed discussion (literature review) on the perceptions of sustainability in ICT4D interventions, as understood by the authors of the 40 articles.

4 DISCUSSION OF SEARCH RESULTS



4.1 INTRODUCTION

The aim of this research is to uncover knowledge pertaining to known perceptions of sustainability in ICT4D within the context of developing communities. Therefore, Chapter 3 of this dissertation is a discussion of the attributes of the ICT4D and ICT4D sustainability articles that were identified through the SLR search process. The articles were sourced from specific ICT4D academic journals and conference proceedings, as discussed in Chapter 2 (methodology chapter) of this research.

Article selection criteria (also discussed in the methodology chapter) were used to qualify the relevance of the searched studies in relation to the purpose of this study. The discussion presented in this chapter is intended to identify and understand the characteristics of the phenomena being studied, based on knowledge extracted from the articles that are deemed relevant to this study. This knowledge primarily represents evidence that informs the research findings and outcomes that are discussed in the next chapter (Chapter 5: Findings).

4.2 DISCUSSION OF SELECTED ARTICLES

The 40 articles are discussed below in order of the year of publication (2005 to 2018). The discussion stipulates each article's perceptions on sustainability in ICT4D interventions. Furthermore, relevant factors related to the sustainability or unsustainability of ICT4D interventions are highlighted, as perceived in each study.

4.2.1 Sustainability in ICT4D according to Kumar (2005)

Kumar (2005) views sustainability in ICT4D from a financial point of view. The role played by other sustainability categories, namely, social, political, technological, and environmental, is of some significance towards achieving sustainability in ICT4D. However, financial sustainability, which is related to the funding model of an ICT4D intervention, is the core driver for achieving sustainability in ICT-enabled development A number of ICT4D initiatives are fully dependent on donor or government funds to maintain their operational capacity from commencement to closure. This means that these initiatives are at risk of ceasing to exist, should the government or donor agency decide to stop providing the funds that are required to maintain operations.

On the other hand, Kumar (2005) notes that some ICT4D initiatives are initially donor or government-funded. This initial funding is based on an investment case that views the ICT4D initiative as a business operation that is intended to generate the necessary profits that will be used to pay back the investment capital with interest, and also provide for its operational costs — including, but not limited to, paying employee wages, maintenance and upgrading of technology, and connectivity costs. The self-funding ICT4D model promotes local entrepreneurship through ICT-enabled development. This model is favourable, because it places more focus on local entrepreneurs to provide affordable, impactful, and relevant ICT products and services in their developing communities. This enables local citizens to participate in the ICT4D, while the entrepreneurs generate income to sustain operations, while implementing technology innovations and satisfying the changing needs of local people.

4.2.2 Sustainability in ICT4D according to Kimaro and Nhampossa (2005)

Sustainability in ICT4D is the intervention's capacity to prevail over time by adapting to the dynamic needs of the in-scope user organisation, and by ensuring sustained socio-economic benefit realisation for local livelihoods. Four barriers are associated with the unsustainability in ICT4D, namely, inadequate infrastructure, inadequate local human capacity, fragmented donor policies, and the lack of policy and strategies to manage sustainability. However, institutionalising ICT4D is a key enabler of sustainability (Kimaro & Nhampossa, 2005).

i. Factors of Unsustainability in ICT4D

a. **Inadequate infrastructure** is noticeable in developing countries. This infrastructure can be categorised into technical (hardware, software) and physical infrastructure (roads, electricity, and transport network), both of which need to be in a sound form to enable sustainability. For example, a lack of access to power — a pre-requisite for the functioning of information systems — makes it impossible to achieve ICT-enabled development or the sustainability thereof. Moreover, constant failure of equipment, which requires support that is not readily available in developing areas, also contributes to the frustration of unsustainability in ICT4D (Kimaro & Nhampossa, 2005).
b. **Inadequate local human capacity** makes it difficult for communities to adopt and utilise ICT4D as a means of improving the poor socio-economic status of impoverished areas. This is because poor economies have a shortage of the skills and experience that are necessary for ICT-enabled development. The required skills are broad and not limited to technical skills, but include management, financial, legal, and other skills. In early ICT4D implementations, most of these skills were provided by donor agencies that funded ICT4D implementations without adequate plans to transfers skills transfer to local people, due to poor donor exit strategies. Therefore, regrettably, when donors relinquish an ICT4D implementation, local officials fail to sustain the mandate of the ICT4D implementation, resulting in the inevitable abrupt failure of implementation due to inadequate local human capacity (Kimaro & Nhampossa, 2005).
c. **Fragmented donor policy** creates misalignment of expectations between donor agencies and local people. Most ICT4D donors are international agencies or companies that have limited or zero knowledge of the local context, with which they should be familiarised to understand the needs of the target developing community. The ICT4D policies presented by most donor agencies reflect the context of the point of origin, which is largely driven by the developed world. However, ICT4D studies have shown that, while most of these policies may work best in the developed world, they fail in the developing world when implemented

in their standard form, thus causing unsustainability in ICT4D implementations (Kimaro & Nhampossa, 2005).

d. **Lack of policies and strategies** to manage sustainability obstructs the long-term view of sustainability in ICT4D. This means that there are no long-term plans to guide ICT4D implementations forward, especially from a financial sustainability and local human capacity development point of view. In the event that donor funding and support ceases to exist, policies and strategies are needed to ensure the continued operation and relevance of the ICT4D implementation post donor involvement. Therefore, when ICT4Ds are implemented without a projection of how they will be maintained and continue to benefit local livelihoods, it is likely that they will at some point become unsustainable (Kimaro & Nhampossa, 2005).

ii. Factors of Sustainability in ICT4D

Based on an analysis of the unsustainability factors presented above, Kimaro and Nhampossa (2005) argue that institutionalisation is key to achieving sustainability in ICT4D. This entails drafting and communicating ICT4D rules of engagement, through mutually formulated and consented policies, contracts, and codes of conduct between the stakeholders involved in a social context. Institutionalisation promotes accountability and helps everyone within the ICT4D network to understand their role and how it impacts sustainability. Furthermore, institutionalisation is also essential, because it creates a mutual space of interaction and cooperation between various parties for the benefit of achieving a common goal. This common goal is derived from specific guiding principles, which in the case of ICT4D is the achievement of socio-economic development through ICT. This socio-economic benefit realisation needs to be maintained by adapting to the changing needs of people, as it drives and enables sustainability.

4.2.3 Sustainability in ICT4D according to Krishna and Walsham (2005)

Krishna and Walsham (2005) summarise the success of ICT4D into five enablers. These enablers, in no particular order, are as follows:

i. Committed and knowledgeable leadership requires ICT4D officials who work at a strategic macro level, such as government representatives or sponsors of ICT4D initiatives, to understand the complexities of implementing ICT4D interventions. Many leaders in developing countries from the political sphere are resistant to ICT-enabled development, mostly because it is seen as a threat towards their self-enrichment schemes, which are characterised by corrupt activities. It is for this reason that the implementation of ICT-enabled development, and more so its sustainability, depends on committed honest and ethical leaders who are knowledgeable regarding the value of using ICT for development.

ii. The involvement of multiple user groups entails an understanding of the expectations of participating stakeholders, and management of these expectations as they evolve over time. Every stakeholder should be made aware of their roles and responsibilities, while performance monitoring and measurement should be put in place to encourage accountability and corrective action where necessary, for the benefit of achieving sustainability in ICT4D. The reason behind the requirement of multiple user groups is that the implementation of ICT-enabled development requires the collaboration of multiple skills, including legal, technology, people, financial, and political skills.

iii. Organisational structures are required to fully represent the capacity and ability of the multiple user groups participating in an ICT4D initiative. This will eliminate any form of bureaucracy that seeks to undermine the purpose and objectives of the ICT4D intervention(s).

iv. A people orientation is about implementing ICT4D initiatives that cater for local people's needs. Tailoring of ICT4D requires the involvement of local people in order to understand their societal context. The inclusion of the intended developing community encourages local people to participate and promote the intervention based on anticipated benefit, which is then realised in accordance with their needs.

v. Resilience of ICT4D is the fifth and last enabler, as stated by Krishna and Walsham (2005). This enabler emphasises that ICT4D initiatives should be resilient by learning from mistakes made in the past, so that future implementations are improved with the aim of achieving sustainability in ICT4D.

4.2.4 Sustainability in ICT4D according to Jacucci, Shaw, and Braa (2006)

A number of authors have generally linked the unsustainability of ICT4D to a number of barriers. These include limited donor funding that eventually depletes, placing less emphasis on locally groomed expertise, technical prejudice that does not aim to accelerate local human development, narrow developmental interventions that cannot be scaled to broader socio-economic community issues, and pilot project orientation (Braa, Monteiro, & Sahay, 2004; Littlejohns, Wyatt, & Garvican, 2003; Sanford, Kanga, & Ahmed, 1994).

Jacucci, Shaw, and Braa (2006) view sustainability in ICT4D through a concept that they call “local sustainability”, which addresses some of the above-mentioned sustainability challenges. However, the concept of local sustainability is dependent on creating flexible and adaptable global (also known as national) standards that can be tailored to reflect the contextual dimensions of the intended developing community. An ICT4D implementation is not a local, but rather a national, asset. Therefore, standardisation of tools, information, and their governance becomes a significant component of ICT4D, especially because it is integrated at a local level in most developing countries (Avgerou & Walsham, 2000).

Although ICT4D initiative(s) is/are a national asset, scaling it down to meet the needs of local people is critical to achieving sustainability. This requires flexible standards that can easily become relevant and adapted by local developing communities. Moreover, local capacity building (human skills, infrastructure development) should be encouraged to unlock the potential that is necessary to sustain the existence of ICT4D. Sustainability in ICT4D is therefore an ongoing phenomenon that entails negotiating the standards that are imposed at a global or national level for their appropriation to a local level. This negotiation does not occur once, but is rather continuous, because of the changing needs of both the national and local network. Monitoring and managing these changes in a mutual agreement, without the existence of bureaucracy and marginalisation, is also a prerequisite that is necessary to the achievement of sustainability in ICT4D (Shaw, Braa, & Jaccucci et al, 2006).

4.2.5 Sustainability in ICT4D according to Kumar and Best (2006)

Kumar and Best (2006) used a case study approach to identify some of the causes of sustainability failure in ICT4D. The case study involved a failed e-government intervention aimed at achieving socio-economic benefit realisation for the local people in rural India. A number of critical failure factors, namely, training, sustained leadership, institutionalisation, evaluation and monitoring, and power shift were perceived to have negatively impacted the intervention, causing it to become unsustainable.

These critical failure factors were identified by studying various components associated with the Sustainable Access in Rural India (SARI) e-government initiative. The components included community context, technology, stakeholders and their relationships (government officials, users, employees, local leaders, and private sector), and change that affected the e-government initiative. Based on the study of these components, Kumar and Best (2006) identified the critical failure factors that resulted in the unsustainability of the e-government intervention.

Training, as critical failure factor, was associated with users of the e-government system, including government employees and the rural people of India. It was noted that some employees did not have the skills and training that were required to execute their jobs on the ICT platform. Secondly, there was no one to assist or train local people on navigating or using the system. The findings of the study indicate that there was nothing wrong with the system. However, the target user group could not use the system because of inadequate knowledge (Kumar & Best, 2006).

Kumar and Best (2006) also understood that a lack of commitment from political and local leadership was another critical failure factor. This lack of commitment was largely driven by a sense of resistance from officials to the e-government intervention, as it had the potential to eliminate corruption. It was discovered that there were a lot of opportunities for corruption for political and local leaders, who dictated the services in the traditional approach of providing government services at particular physical locations limited by operational time. Local people had to pay bribes to officials in order to obtain free government services. For this reason, some officials and local leaders

saw the e-government ICT4D implementation as a threat that would prevent them from illegally making money.

The dynamic nature of the ICT4D components was not managed appropriately to prevent it from having a negative impact on the ICT4D implementation. When skilled workers, who understood the functioning of the e-government system, resigned or transferred to other departments, they were not replaced by workers of the same calibre. Furthermore, no activities took place to indicate that effort was being made to transfer these skills to the existing workforce. This had a tremendous negative impact on the initiative, as the quality of services continued to diminish, causing local people to start to neglect participation in the e-government initiative and revert back to the traditional approach that continued to benefit bureaucrats.

Kumar and Best (2006) argue that these critical failure factors all form part of political or institutional sustainability. They state that, depending on the context of the target developing community, each general sustainability category is impacted differently. When considering the e-government initiative in rural India, the context of the community is one that required prioritisation of the political/institutional sustainability category. This would imply that all stakeholders would have been engaged to understand their expectations and motivations, including roles and responsibilities, which would have promoted stakeholder relation transparency and accountability. In addition, proper change management (including tanning policies and standards), complemented by monitoring and review processes, could have been implemented to achieve institutional and overarching sustainability in ICT4D in the case of the e-government initiative.

4.2.6 Sustainability in ICT4D according to Kuriyan, Toyama, and Ray (2006)

Kuriyan, Toyama, and Ray (2006) perceive the relationship between social and financial sustainability as the main enablers of sustainability in ICT4D. Their study assessed the sustainability of an ICT4D intervention that was implemented in rural India through a government and private sector partnership. Kurian, Toyama, and Ray emphasise that their findings are common to developing communities, irrespective of geographic location.

A number of stakeholders, with varying roles and responsibilities, participated in making the existence of the ICT4D intervention possible. The actors had varying expectations and motivations for participating in the ICT4D intervention. Some actors were inspired by the perceived financial benefit, while others related to the anticipated social benefit. This implies that ICT4D is not a simple technical process for providing services to the poor and marginalised communities. Instead, it is a political process that entails balancing and prioritising certain related and unrelated building blocks that collectively enable sustainability in ICT4D (Ray, Toyama, & Kuriyan et al, 2006).

The branding of ICT4D interventions also affects social and financial sustainability. ICT4D is largely linked to government efforts for improving the lives of local people. This develops expectations of free services amongst local people, with the majority of expectations being amongst the poorest. On the other hand, those who can afford the services are not as vocal due to the fact that, regardless of the financial model of the ICT4D implementation, they still stand to participate. This creates the requirement for a balance between social and financial forces to enable sustainability. In other words, Kuriyan *et al.* (2006) argue that social and economic sustainability can only exist when the needs of all parties involved are addressed by implementing the ICT4D solution.

4.2.7 Sustainability in ICT4D according to Ali and Bailur (2007)

Ali and Bailur (2007) argue that sustainability is a concept that is simply not practically possible. According to most ICT4D studies, the concept of sustainability is about stability, but yet progression. However, these studies do not articulate clearly what is meant by stability and progression. These studies attempt to operationalise sustainability by focusing mostly on the upkeep of the ICT artefact, rather than on the needs of the subject community.

According to Ali and Bailur (2007), the failure of ICT to realise its intended development objectives is often viewed by ICT4D authors as unsustainable. This failure could be as a result of known or unknown factors that compromise one or more of the sustainability categories that impact the context of the target developing community, including economic, social, political, technological, and environmental aspects. However, instead of declaring this failure as unsustainability, Ali and Bailur emphasise that it

should rather be viewed as an opportunity that can set a different direction for achieving development through ICT, as well as encourage benefit that may be realised in a different form to what was originally anticipated.

Sustainability is a narrowed concept that is made to focus on emphasising the design-actuality gap of an ICT4D intervention. This implies that, if the ICT4D implementation fails to turn theory (design) into practice (actuality), then stakeholders such as sponsors may consider this as development failure and therefore revoke their sponsorships.

Ali and Bailur (2007) used two distinct ICT4D case studies as examples of this sentiment. These case studies both focus on the use of ICT to achieve development. However, because the ICT implementation was not used (actuality) as intended (design) in both case studies, this was declared as ICT4D failure. On closer look at the two case studies, Ali and Bailur noticed that some categories of sustainability were achieved, including financial, technological, and political. What led to the misuse of the technology artefact was that the design did not depict the needs of the local people. When using the technology, local people found it useful for means that were not viewed as development by the designers of both ICT4D interventions. The misalignment between design and actuality resulted in the unsustainability of both interventions. Based on this, Ali and Bailur argue that sustainability is not possible, as a number of known and unknown obstacles — including changes to technology, limited financial resources, scarcity of skills, little or no user/community buy-in, and static strategies — are some of the challenges that prevent the realisation of sustainability.

Ali and Bailur (2007) propose the concept of "bricolage" as a substitute for “sustainability", by stating that sustainability is good in theory but complex to operationalise, considering the infinite number of impediments that may exist in developing communities. The concept of bricolage is about evolving and adapting to change, regardless of whether the change relates to financial, social, political, technological, or environmental aspects in the developing community’s context. With reference to the two case studies, Ali and Bailur (2007) state that the alternative usage of technology by local people should have been viewed as an opportunity for possible unplanned development rather than being categorised as development failure.

Unintended change is always inevitable and should not be seen as a threat, but instead viewed as an opportunity to drive development of a different nature based on the resources and interactions at disposal, which is what the bricolage concept emphasises.

4.2.8 Sustainability in ICT4D according to Grunfeld (2007)

Grunfeld (2007) emphasises that, for ICT deployment to be sustainable, the lives of individuals, businesses, and communities should be impacted at a micro level through social and economic benefit realisation. This sentiment primarily focusses ICT-enabled development on improving the well-being of people in the intended developing community. However, this should complement rather than impede the motivations and expectations of other affected stakeholders, including but not limited to sponsors, service providers, and local/national authorities.

Most ICT4D interventions that employ a top-down approach have frequently proven to be unsustainable. This is the case where the requirements and capabilities of the macro-level actors (especially those of sponsors/donors) precede or are prioritised without much consideration of the needs and capabilities of the intended developing community. In most cases, this approach leads to misalignment between the supply and demand of ICT4D in relation to the socio-economic context of the developing community (Grunfeld, 2007).

Grunfeld (2007) uses the framework in Figure 4.1 to conceptually illustrate the foundational segments that contribute to ICT capabilities, empowerment and, more importantly, the sustainability in ICT4D interventions. This framework encourages a participatory or inclusive environment that effectively creates a collaborative network between key stakeholders of ICT4D at the macro, meso, and micro level to ensure that the goal of sustainability in ICT4D is achieved.

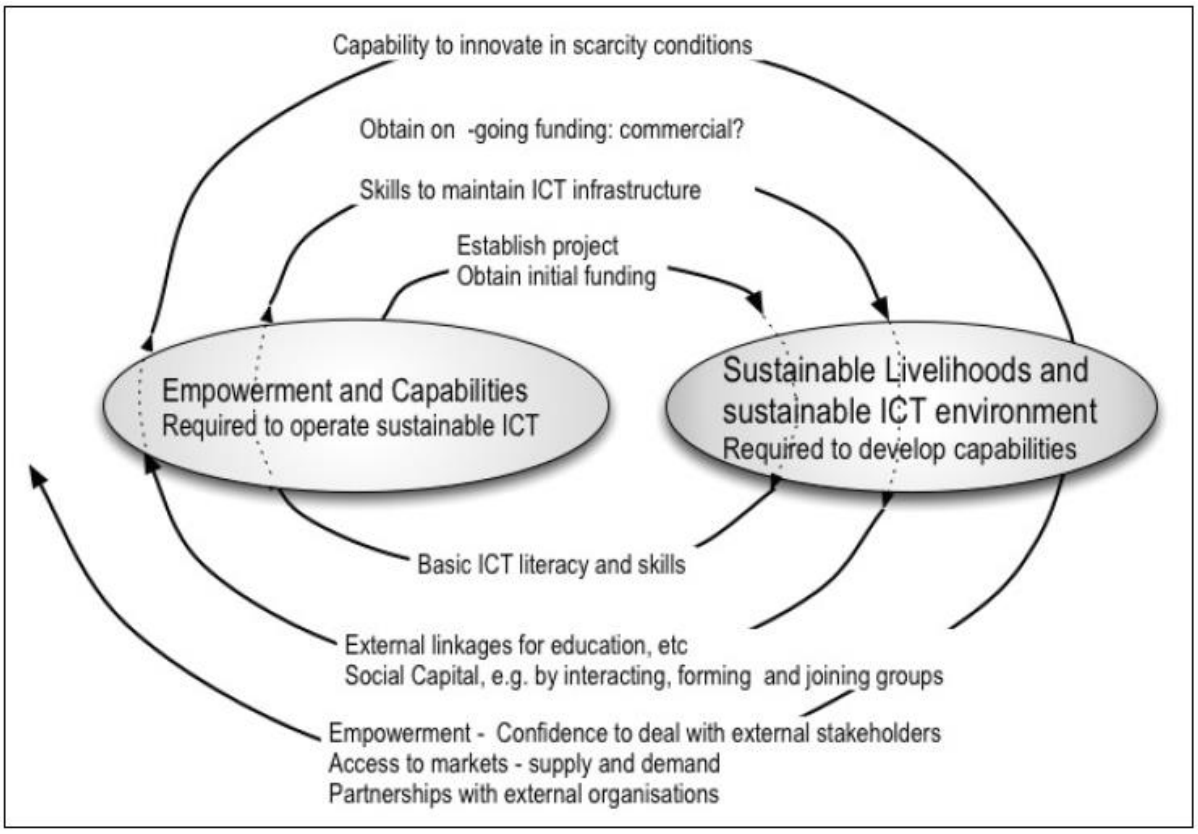


Figure 4.1: *Virtuous spiral – Empowerment/Capabilities and Sustainable Livelihoods and ICT (Grunfeld, 2007:10)*

Grunfeld's framework in Figure 4.1 indicates that the primary enablers of sustainability are observable at a micro or community level. However, depending on the socio-economic context of the target developing community, these enablers are influenced by various other factors. Therefore, intervention from meso and macro-level actors is required to provide the necessary support for the sake of achieving sustainability. This framework implies that every stakeholder has a role to play to achieve sustainability in ICT4D. For example, donor funding at a macro level, technical support from service providers at a meso level, and benefit realisation for the developing community at a micro level all need to co-exist in order to realise sustainability.

4.2.9 Sustainability in ICT4D according to Gerhan and Mutula (2007)

Sustainability in ICT for development is largely influenced by the manner in which such interventions are tailored to reflect the needs of the target population. Most developing countries face social and economic challenges that threaten sustainability in ICT4D. Barriers including, but not limited to, illiteracy, crime, poverty, poor or no ICT

infrastructure, and strict traditions are some of the attributes that form part of the context of developing communities (Gerhan & Mutula, 2007).

Gerthan and Mutula (2007) argue that sustainability in ICT-enabled development is largely dependent on the applicability of the intervention to the needs of the intended community. Extensive evaluation of the community's context is required to enable the implementation of a tailored rather than generic ICT4D intervention. Local people should be consulted and included in the entire lifecycle of the ICT4D intervention, from design to implementation, so that they can be motivated to participate in the ICT4D, knowing that it is for their social and economic benefit.

The inclusion of local people is a prerequisite for driving benefit realisation that is relevant. However, this is just the first step towards achieving sustainability. Gerthan and Mutula state that, when people start to realise the benefit of ICT4D, their original needs become less relevant as they become dynamic and flexible to the changing capabilities and physical context. It is for this reason that ICT4D should also adapt to these evolving requirements that reflect a changing developing community context (Gerhan & Mutula, 2007).

Financial sustainability is another consideration in the changing ICT4D landscape, that can be achieved through commitment of continued sponsorships from donor agencies and the governments of developing nations. Another way of ensuring financial sustainability is by implementing initiatives that are aimed at generating profit to cover operational costs and other financial needs, when a shift in the baseline context results in new requirements of the developing community. Alternatively, these two methods can be combined to complement each other and perhaps make financial sustainability a little easier to manage. The need for financial sustainability arises not only because of evolving people needs, but also due to the volatile reality of technology that makes it costly to maintain or replace (Gerhan & Mutula, 2007).

4.2.10 Sustainability in ICT4D according to Hosman and Fife (2008)

Hosman and Fife (2008) view sustainability in ICT4D through public-private partnerships, also referred to as the "PPP" concept. The PPP concept emphasises the

formation and management of the partnerships involved in ICT4D implementations. The subject developing community, which is the focus of the intervention, should also be considered as a partner, as the success of ICT4D intervention(s) is dependent on adoption by the recipient community. The scale to which ICT is adopted is influenced by perceived or experienced benefit realisation in local livelihoods.

Acknowledging the developing community as a partner within ICT4D is one of two principles that, according to Hosman and Fife (2008), enables development. The second principle, which complements the first, is planning for long-term sustainability of ICT4D by focusing on the wants, needs, and context of the target population. Together, partnerships and the tailoring of ICT-enabled development, based on the characteristics of the developing community, is essential for achieving sustainability.

ICT-enabled development is a complex and expensive investment that is expected to yield socio-economic development for poor and marginalised communities. It requires extensive resources that cannot be provided nor sustained by one individual party. Collaboration between the public and private sector, including the subject community, is required to form partnership(s). Each party in the partnership(s) has a significant role to play — from either a resource or a skills perspective — to help ensure sustainability in ICT4D. It is important to note that each participating partner in the ICT4D intervention is motivated differently. Certain partners (such as private companies) may be motivated by the possibility of generating profits, while others (such as local government) are motivated by accelerated service delivery. However, each partner's motives should be aligned with the goal of achieving sustainability in ICT4D (Angerer & Hammerschmid, 2005).

Hosman and Fife (2008) argue that ICT4D partnerships should be treated in a way that is beneficial to all stakeholders, by satisfying each partner's motives. In most cases, the motives will be for financial gain. Therefore, the partnership has to be treated as a business venture that has an economic benefit not only for the developing community, but also for the stakeholders who form part of the partnership. The dynamics of the partnership should reflect a multi-stakeholder approach, whereby a range of actors from both the public and private sector are engaged in the ICT4D intervention, based on their resource or skills capability that is necessary for sustainability. Actors in the

ICT4D partnership may include national governments, international donor agencies, regional groups, local authorities, developing community NGOs, and those from the private sector. The partnership should also be sufficiently flexible to absorb new members as it evolves.

The significance of acknowledging the target community as critical stakeholder in the partnership is that it allows the ICT4D intervention to be designed and implemented in a manner that caters for the desires and needs of the target community. Sustainable partnerships, together with continuously meeting and improving the social and economic needs of the developing community to drive sustained socio-economic benefit realisation, is what enables sustainability in ICT4D (Hosman & Fife, 2008).

4.2.11 Sustainability in ICT4D according to Best and Kumar (2008)

Best and Kumar (2008) conducted a sustainability in ICT4D study based on telecentres implemented in rural India. The telecentres were aimed at promoting development through various social and economic aspects, including literacy, employment, and access to certain government services. Best and Kumar wanted to identify attributes that eventually led to the unsustainability of some telecentres and the sustainability of others during the three year duration of their study.

In the course of their analysis, Best and Kumar identified four main sustainability categories that systematically influenced the operational outcome of these telecentres. This influence had an impact on the local development agenda. Best and Kumar argue that, although their study pointed out four sustainability categories (namely; financial, technological, institutional, and social) as the reason for the unsustainability of some telecentres, it is important to note that the unsustainability of the technological category was what eventually caused the unsustainability of the other three categories. This indicates that, if technological sustainability had been realised, then the other sustainability categories would perhaps have been achieved, and that the failed telecentres could have continued operations for the benefit of local rural Indian people.

The characteristics of the telecentres differed, in that some telecentres were donor-funded and also regularly subsidised by donors and other local partners from a

financial and technical perspective. On the other hand, some telecentres were only donor-funded during establishment; however, they were required to self-sustain operationally and financially from income generated on the fees charged to local people for using the telecentres' services. Best and Kumar realised that, post the three year duration that their study was conducted, it was the telecentres that adopted the self-sustainability model that were in the end unsustainable. On the contrary, most of those that were subsidised on a continuous basis remained open beyond the three year mark.

A lack of technological, financial, institutional, and social sustainability was ultimately identified as the reason for the unsustainability (closure) of the self-funding telecentres when compared to the subsidised ones. It was discovered that, sometime during the operation of the failed telecentres, there was little to no technical support and servicing of the telecentres. It is not known what caused the company entrusted with technical support to stop providing such services. However, this had a negative impact on the failed telecentres, as some of their income-generating services — including email, video conferencing, and telephony — had to be stopped due to broken hardware and a lack of internet connectivity, which was necessary to conduct these services. These self-funding telecentres lost much needed revenue to pay employees and suppliers of products and services, leading to the inevitable unsustainability or failure of thereof.

After conducting interviews with local people to understand their experiences with the failed telecentres, Best and Kumar discovered that a significant number of local people also stopped using the telecentres on the basis of irrelevant content and services. This means that the services that were being offered at some failed telecentres did not appreciate the local context in which they operated. This also probably had a negative impact on their revenue.

In summary, the sustainability failure of these telecentres was due to a collection of factors. The primary factors included a deficiency of technical and institutional support. In addition to this were the social elements, by which some telecentres did not provide the services that were reflective of local needs. Collectively, the aforementioned sustainability categories all had a significant negative impact on financial sustainability. Overall, these categories hindered the objectives of the ICT4D intervention and its

sustainability. This is because the social and economic development objectives, including benefit realisation for the local people, were partially or never realised. Furthermore, a lot of resources were applied to the ICT4D intervention, which in the end did not produce the intended or desired outcome for all stakeholders involved.

4.2.12 Sustainability in ICT4D according to Silivus, Van Den Brink, and Smit (2009)

According to Silivus *et al.* (2009), sustainability in ICT4D should be interpreted based on the outcome and impact of an ICT initiative in relation to the developing community's context. The operational results of an ICT4D intervention should encourage a positive and balanced atmosphere between the social, economic, and environmental conditions that enable continuous benefit realisation for the target population. In other words, for an ICT4D initiative to be considered sustainable, it needs to maintain improvement of the livelihoods of the current population of the developing community without compromising the needs of future generations from a social, economic, and environmental perspective (Labuschagne and Brent, 2006).

Sustainability in ICT4D largely depends on the impact that it has on the lives of the local people as well as the natural setting that they occupy. ICT endeavours should drive positive financial and social benefits without harming the natural surrounding that is occupied by local people, whether in a rural or urban developing environment. Silivus *et al.* state that the most significant factors that influence sustainability in ICT4D are financial sustainability, environmental sustainability, and social sustainability. Together, these three factors must be fulfilled harmoniously in order to realise any form of sustainability in ICT4D. ICT4D interventions should be financially sustainable and should first and foremost help to create financial benefits for local people. Thereafter, it should protect the environment of the developing community from any harm such as dumping of unwanted hardware. Finally, an ICT4D intervention must focus on developing communities based on their context, including but not limited to culture, education, and religious beliefs.

4.2.13 Sustainability in ICT4D according to Pade, Mallinson, and Sewry (2009)

Pade, Mallinson, and Sewry (2009) acknowledge that most ICT4D literature emphasises financial sustainability (cost recovery) as the main consideration for achieving sustainability in ICT4D. However, they state that achievement of sustainability in ICT4D requires that an intervention should meet the needs of the developing community, achieve local value creation, and be implemented on the basis of factors such as cultural and political sustainability. Pade *et al.* (2009) argue that these factors are parts of a whole that affect sustainability in ICT4D. According to Pade *et al*. (2009), ICT4D sustainability should be viewed as being enabled by nineteen critical success factors that support one or more of the general sustainability categories, excluding environmental sustainability, as can be seen in Table 4.1.

Table 4.1 Classification of the critical success factors into the general sustainability categories (Pade *et al.*, 2009:11)

Categories of sustainability / CSFs	Social and cultural	Institutional	Economic/financial	Political	Technological
1. Simple and clear project objectives	*	*	*	*	*
2. Approaching the project in a holistic way	*	*	*	*	*
3. Using ICT to enhance existing rural development activities	*	*	*		
4. Cultivating an enthusiastic influential project champion	*	*	*	*	*
5. Incorporating socially excluded groups	*				
6 Incorporating/awareness of specific ICT policy influencing the project		*		*	
7. A good understanding of the local political context				*	
8. Significant participation of community target groups in the project process	*	*		*	
9. Focusing on local/demand driven needs	*	*			
10. Building on local information and knowledge systems	*				
11. Appropriate training and capacity building		*			
12. Facilitating local content development	*	*			
13. Existing motivation and incentive for ICT job placement in the community	*	*	*		
14. Focus on economic self-sustainability - business development (entrepreneurship)			*		
15. Encouraged local ownership		*			
16. Building local partnerships	*	*	*		
17. Choosing the appropriate or right technology	*		*		*
18. Building on existing public facilities	*				
19. Ongoing monitoring and evaluation of the project	*	*	*	*	*

Each of these factors are discussed next.

1. **A simple and clear project objective** is required and must be tailored to reflect the needs of the developing community. This should be clear and precise and well communicated to all stakeholders, in order to drive inclusion and accountability and to assist everybody to understand and agree to the roles and responsibilities that they are expected to, and should, execute.
2. **A holistic project approach** in relation to the local needs of the target developing population should be undertaken for the duration of the ICT4D intervention. The aim should be for ICT4D efforts not only to focus on small scale development, but rather to take a broader perspective on how local livelihoods can be improved, considering the technological resource capacity and sustainability of the ICT artefacts.
3. **Usage of ICT to increase current community development activities** - ICT4D projects should consider sharing their ICT artefacts across various development activities within the local community, in an attempt to expand the impact and benefit realisation that will promote the popularity of the intervention to the extent that people appreciate its existence from a broader perspective.
4. **Incorporation of an influential project champion** that is preferably a known and respected individual within the local community such as a chief, a priest, or a community leader is advisable. The champion will be tasked to ensure that the local people engage and participate in the ICT4D intervention.
5. **Inclusion of socially excluded groups** is required to eliminate any form of social or cultural discrimination. ICT4D should cater for all demographics that occupy the developing community, regardless of gender, ethnicity, religion, and any other socio-cultural aspects. Awareness of creating a social and cultural balance should be embedded in, and communicated through, the policies and strategies of the ICT4D initiative.
6. **ICT4D Policy Design and Communication** is necessary to drive sustainability in ICT4D. Policy should be used by ICT4D decision makers as a mechanism to influence positive interaction between the developing community, sponsors, and ICT artefacts, based on policy guidelines that enable sustainability in ICT4D when applied effectively.
7. **Knowledge of the local political context** is another factor that must be considered and managed progressively during the operational period of the ICT4D initiative. This is because political influence is required to promote the

ICT4D initiative in the target population, as well as to gain support from the local government.

8. **Participation of community target groups** in both the design and implementation stages should be encouraged, so as to tailor the ICT4D intervention to the context of the target population. This inclusion will ensure that the ICT4D intervention achieves its mandate based on the needs of the local people. Frequent engagement with the community will increase user motivation, and allow for the ICT4D intervention to incorporate local feedback and reflect on the local context, so as to become even more useful and impactful.
9. **Focusing on local/demand driven needs** - ICT4D implementations should be based on, and continue to cater for, local demand for products and services in the developing community's context. Therefore, ICT4D stakeholders must not implement ICT projects because there is enough supply, but should rather focus on assessing whether there is a need for the proposed initiative(s) in the target developing community.
10. **Building on local information and knowledge systems** to create locally relevant content that can be understood, shared, and used by local people on a regular basis, so that ICTs remain impactful for the entire duration of the initiative.
11. **Appropriate training and capacity building** is required to cater for the skills level and skills gaps in the local community, thereby enabling people to participate accordingly in the ICT4D intervention. A train the trainer approach is more adequate to maximise the local spread of skills. The training should entail content development, technical support, and support for development tasks, so as to complement sustainability in ICT4D.
12. **Facilitation of local content development** that the target developing community can relate to is required, in order to ensure continued relevance and usefulness of the information in relation to the local context that people understand and experience on an everyday basis.
13. **Motivation and incentive for ICT job placement in the developing community** - the ICT4D should increase economic opportunities for the local people. Therefore, the initiative should endeavour to employ the majority of the trained and skilled local people in order to improve their livelihoods through

economic opportunities that arise from ICT implementations. It is these economic benefits that impact the community positively and cause the ICT4D initiative to be embraced or accepted by people in developing communities.

14. **Focus on economic self-sustainability (entrepreneurship)** - it is important for ICT4D stakeholders to encourage strategies that enable the ICT4D initiative to be economically self-sustainable. This implies that the initiative should not entirely depend on donor or government funding for its operation, but should rather present a model that promotes economic self-sustainability by ensuring that it generates enough income to provide for all operational costs during its intended lifetime. This is because donor and government funding are sometimes finite, leading thereto that the ICT4D initiative becomes financially compromised when funding is depleted; this, in turn, leads to the failure of such an initiative and its sustainability.
15. **Encouraging local ownership** - this will allow local people to feel empowered to participate in the ICT4D and support its existence, because it will facilitate the benefit of improved local livelihoods, both socially and economically.
16. **Local partnerships** are required where possible, depending on the capacity and capabilities of the various actors that are needed for the technical or financial support of the ICT4D initiatives. ICT4D interventions must incorporate the building of local partnerships, because these are institutions that are trusted by local people, and that also understand the community context. These partnerships aid in creating the trust that strengthens relationships between local and global stakeholders, so that sustainability in ICT4D can be achieved.
17. **Choosing appropriate technologies** is another essential pre-requisite of sustainability in ICT4D. As technology is at the centre of ICT4D interventions, it is important to understand the current infrastructure capabilities of the developing community so that technology investment decisions can be prioritised. For instance, a project that is aimed at introducing e-learning in rural schools by providing desktop computers in a rural area that has no connectivity infrastructure and no electricity, will have to prioritise electricity and connectivity prior to donating desktop computers. Prioritising and choosing appropriate technologies allow the ICT4D initiative to effectively carry out its mandate of socio-economic development by bridging the digital divide, to gain access to equal opportunities through the use of ICT.

18. **Building on existing public facilities** - the target community and local leadership should provide an adequate environment in the form of a building that will house the ICT artefacts that are required for development. This responsibility should be placed in the hands of the local community. The community must offer adequate security to prevent theft and vandalism, and provide basic needs such as water and electricity as convenience to the local users.
19. **Frequent monitoring and evaluation of ICT4D** is the last critical access factor that Pade *et al*. (2009) suggest will ensure sustainability in ICT4D. They state that, when the ICT4D project is continuously monitored by stakeholders, it is easy to identify improvements on an ongoing basis, based on the changing needs of the developing opportunity. This will allow for the improvements to be planned and adapted timeously, so as to sustain benefits with a positively impact for improved local livelihoods from a socio-economic perspective, thus ensuring the relevance and usefulness of ICT4D in the community.

4.2.14 Sustainability in ICT4D according to Bailey (2009)

The concept of sustainability has largely been associated with financial sustainability in most ICT4D studies. Financial or economic sustainability does indeed play a key role in ensuring the operational capacity of the ICT4D. This entails, but is not limited to, paying employee wages, catering for technology maintenance and connectivity costs, and producing profit for the owners of the ICT4D implementation. All these financial requirements are critical to sustainability in ICT4D, as stated or argued in most ICT4D literature (Colle, 2005). However, Bailey (2009) argues that sustainability in ICT4D should primarily be considered from the social aspects that pertain to local people impact.

According to Bailey (2009), ICT4D is aimed at achieving social and economic development that improves the lives of people in developing communities; therefore, it is only through meeting their needs that development can be truly achieved. Secondly, a monitoring process to evaluate possible changes to these needs should be implemented to adapt the ICT4D into effective tailored change, based on the evolving target community needs. In other words, for ICT4D interventions to be sustainable,

they need to have a positive beneficial impact on the lives of local people. This would promote the ICT4D intervention, and increase participation and acceptance. Bailey's findings about sustainability in ICT4D are based on an empirical study that used an interview method to understand the views of various stakeholders in relation to sustainability in ICT4D. The shared sentiment between these critical stakeholders (including sponsors, government officials, employees, members of the developing community, and local leaders such as priests and headmen) was that ICT4D needs to be demand-driven. ICT4D interventions should prioritise the context of the developing community, and continuously reflect on the changing needs of the local people in order to realise sustainability (Bailey, 2009).

4.2.15 Sustainability in ICT4D according to Brunello (2010)

The primary driver of sustainability in ICT4D is to align its implementation to the needs of people in developing communities. This enables the benefit realisation that is necessary to facilitate acceptance and support of ICT-enabled development by the target community. As development affects and causes the needs of the developing community to change, monitoring mechanisms must be put in place to adapt to these needs as they evolve. In other words, local people must continuously be engaged to understand how ICT4D can be refreshed or updated to complement identifiable gaps between traditional and modern needs. Sustained benefit realisation in ICT4D is a critical enabler of sustainability, and it can only be achieved when ICT4D continues to be demand-driven to meet the dynamic needs of the target developing community (Brunello, 2010).

4.2.16 Sustainability in ICT4D according to van Rensburg, Cronje, and du Buisson (2010)

An ICT4D intervention is composed of a network of actors, who represent the macro to the micro level. The macro level includes ICT4D-enabling actors such as the national government, development partners/sponsors, and technology partners. Micro-level actors include supporting and recipient actors of ICT4D, such as the local government, development agencies, service providers, and the target developing community. In recent years, ICT4D implementations have been dictated by the macro-level actors

who have minimal to no knowledge of the local recipient context. This is known in ICT4D research as the top-down approach, and has been known to be an unsustainable method for introducing ICT-enabled development (van Rensburg, Cronje, & du Buisson, 2010).

According to van Rensburg *et al.* (2010), the only way to achieve sustainability in ICT-enabled development is to focus more on satisfying the socio-economic needs of the target population. An impact assessment should therefore be conducted, based on the context of the intended developing community. The idea behind the impact assessment is to understand the manner in which ICT4D can improve local livelihoods, so that it can be implemented accordingly to ensure that it is relevant and supported by the community. A number of elements in the context of the developing community should be considered, as depicted in Figure 4.2, to understand how the participants in an ICT4D intervention will be impacted.

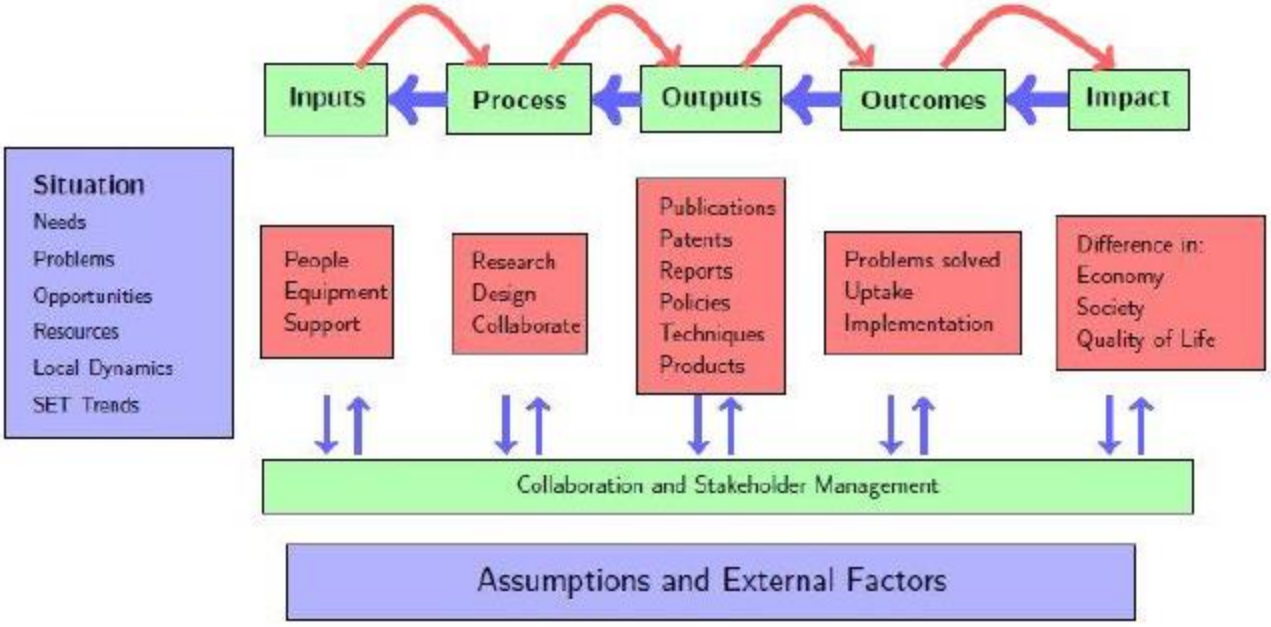


Figure 4.2: *CSIR Impact Assessment Logic Model (van Rensburg* et al., *2010:9)*

Although the impact assessment should primarily emphasise the needs of the intended population in a bottom-up approach, the expectations and motivations of other stakeholders must also be managed appropriately. There has to be a balance ("equilibrium") that caters for every stakeholder's needs within the ICT4D network, so as not to favour one party over the other. Monitoring activities that evaluate the evolving needs and relationships between stakeholders must also be put in place, so as to

manage and adapt to these dynamic changes effectively towards achieving sustainability (van Rensburg, Cronje, & du Buisson, 2010).

Lastly, van Rensburg *et al.* (2010) state that the ICT4D network must have a strong institution, guided by the common goal of achieving sustainability in ICT4D. Core institutional principles or values, summarised in Table 4.2, form the basis of accountability and reconciliation within the ICT4D network.

Table 4.2 The network's organisational principles and practices **(**van Rensburg *et al.*, 2010:5)

Principles	Practice
Ubuntu business (the network is 'it')	**The network acts as collective in all activities (design and implement business processes to be spread over the network)(every activity aims to create and enhance inter-dependency)**
Returns on the basis of value addition	**Sweat'** to be **rewarded justly** (with due consideration of the 'place' of optimal value addition)
Local is 'lekker'' (and ultimate)	An Infopreneur is a 'local' **and** the network always **engages with end-users through the 'local' Infopreneur** (i.e. the network member nearest to the client 'serves' the client)
Social entrepreneurship at all levels	All Infopreneurs' activities to include a clear, balanced consideration for **both** the **entrepreneurial** and **developmental** objectives
Development through enterprise	Primary focus of network's members' activities is to **create and sustain development momentum through** (community level) **enterprise creation and support**
No channel, no implementation	No **Master Infopreneurs** means **no Community Infopreneurs**
Aware and aligned but not owned	The network plays in the **middle ground** between **private and public sector** and **aligns itself with both without being owned** by any of them
Effective inquiry	The network will use **new ways of documenting and sharing knowledge** and will be **open to new perspectives that will link learning to action** - for impact and further learning - no learning for its own sake. It includes ongoing organisational reflection to determine how the network itself is learning, how it is applying its learning and how it is becoming more effective as a result
ICT follows culture	ICT strategy will be responsive to the needs of especially rural communities - it's not about technology, it's about **tools that enable people to capture, share and build knowledge**
Primacy of communities	The **development agenda of the community** becomes the Service Delivery Enterprise's **focus** through the eyes of the Infopreneurs

In summary, in order to achieve sustainability, ICT4D should reflect the context of the developing community while complementing the changing expectations and motivations of other actors within the ICT4D network. The network must also be driven by strong institutional structures and values.

4.2.17 Sustainability in ICT4D according to Marais (2011)

Marais (2011) perceives sustainability in ICT4D as enabled more by the contextual human element than the technology aspect. This is because ICT4D is aimed at creating the socio-economic benefit that is necessary for improving the lives of people in the target developing communities. It is this anticipated and experienced benefit realisation that drives local people to participate in ICT4D initiatives (Toyama, 2010).

Although technology plays a critical role in ICT4D, Marais (2011) argues that the context and realities of the lives of people in developing communities are what triggers the need for ICT4D to improve undesirable social and economic situations. Therefore, the benefits that are realised by locals who participate in the use of ICT initiatives that are aimed at promoting development, are major contributors or enablers of sustainability. It is ultimately what determines whether people are impacted positively or negatively by ICT4D. Technology is in this case an artefact that, when managed appropriately through institutional structures such as policies, can exist regardless. However, its contents must take guidance from the needs and context of the target population, so that it can remain useful and relevant.

4.2.18 Sustainability in ICT4D according to Hosman (2011)

Hosman (2011) identified a number of attributes that collectively influence sustainability in ICT-enabled development. Discussed in no particular order, Hosman states that ICT4D should take a demand-driven approach. This implies that ICT4D must be tailored to meet the needs of the target population at an affordable fee. It is easier for people to participate and accept ICT-enabled development when it is deemed relevant to their context and helps them realise socio-economic benefit. However, the ICT4D should not be static, but rather dynamic and adapt to changing needs once it implemented. Efforts to continuously attract more people within the developing community irrespective of demographics, by offering different content

through innovation, must be encouraged and practiced. The innovation should be communicated to the developing community for awareness.

Hosman (2011) mentions stakeholder commitment as another important attribute that affects sustainability in ICT4D. The formation of stakeholder relations should be undertaken with a long-term view of the ICT4D implementation. The stakeholders involved should be made aware of their roles and responsibilities and, more importantly, agree to their terms of reference regarding their participatory mandate. Each stakeholder should be incentivised accordingly, depending on the agreements that exist. Changes to these agreements, based on evolving stakeholder expectations and motivations, should be managed appropriately and communicated within the network of affected stakeholders to achieve sustainability in ICT4D.

4.2.19 Sustainability in ICT4D according to Vaughan (2011)

The contribution of an ICT4D initiative to the well-being of the developing community influences sustainability. ICT4D must be tailored to reflect and improve the capabilities of the intended developing community. Improving local capabilities from a social and economic standing encourages people to see the value of ICT4D. In return, this experienced well-being motivates people to continuously participate and support ICT4D (Vaughan, 2011).

Vaughan (2011) states that a number of ICT4D interventions fail because they follow a top-down approach. This approach revolves around designing and implementing ICT4D policies and strategies that are based on the requirements of donors or sponsors. Unfortunately, most of these donors or sponsors are not from the intended community, which means that they cannot relate to its context. Generally, donors and sponsors are concerned with providing ICT access, whether technical or financial, to enable development. However, studies have shown that most top-down ICT4D initiatives have failed to be sustainable post donor or sponsor involvement (Alampay, 2005).

Collaboration between the various stakeholders that make up the ICT4D intervention — more specifically, engaging the target community to understand their needs and

capabilities — is key to achieving sustainability. The well-being of the community should be the priority of the ICT4D intervention. Therefore, designing and implementing ICT4D policies that follow a bottom-up approach, by placing emphasis on how technology can be used to improve the lives of local people based on their needs and capabilities, is the primary driver of sustainability. These policies and strategies should be flexible in nature to allow for the absorption and adaptation to changing community needs and capabilities as they evolve over time (Vaughan, 2011; Kleine, 2010).

4.2.20 Sustainability in ICT4D according to Pade-Khene, Mallinson, and Sewry (2011)

Pade-Khene *et al.* (2011) focussed the scope of their study on the rural communities of developing countries. They proposed and described three areas that should be considered and satisfied in order to achieve sustainability in ICT4D within rural settlements. The first area is about promoting ICT4D initiatives that are community driven. The second area encourages the introduction of ICT4D through pilot projects. The last area illustrates the benefit of having an ICT4D intervention that is iterative and incremental in nature. When these three areas are applied effectively and in combination to ICT4D interventions, the sustainability of such interventions in rural communities can be achieved.

Community-driven ICT4D entails putting the needs of the local people first. This practice enables sustainability as a result of enhanced community buy-in. The latter can only be achieved when local people are continuously engaged to create awareness regarding the potential benefits of ICT4D and the impact that it may have on existing challenges such as poverty and lack of development. Pade-Khene *et al.* (2011) state that local people in rural dwellings may resist ICT4D interventions if the intended benefits are not communicated or realised. Therefore, to achieve sustainability in ICT4D, local people must embrace, accept, and support the intervention. Community buy-in can only be achieved when the benefits of ICT4D are well communicated and the ICT4D intervention follows a demand-driven approach, whereby the needs of the people form the foundation for implementing ICT4D in order to realise the socio-economic benefit that is tailored to meet these needs.

The second area that enhances the probability of sustainability is the implementation of an ICT4D intervention as a pilot initiative or project. This allows people to experience the promised benefits on a small scale. Pade-Khene *et al.* (2011) argue that rural people do not have much exposure to technology. This makes it difficult for them to simply accept ICT4D on the basis of promised benefit. The intended benefits have to be practically experienced by ordinary people for an ICT4D intervention to be accepted and supported in rural areas. Piloting ICT4D to initially showcase the promised benefits on a small practical scale is essential for promoting community buy-in. Once this is done and people see the potential in ICT-enabled development, then ICT4D can be accelerated to meet other more pressing needs of the developing community, leading to an even greater acceptance and scale of support.

Third and lastly, ICT4D interventions need to be iterative and incremental in nature. Flexibility of the ICT4D intervention to meet the evolving needs of the target community is another important component that enables sustainability. The lessons learnt must be applied accordingly, as the evolution of the ICT4D intervention is guided by the dynamic demands of the community (Mallinson, Sewry, & Pade-Khene et al, 2011).

4.2.21 Sustainability in ICT4D according to Masiero (2011)

Masiero (2011) argues that sustainability in ICT4D depends on the relationship between financial and social sustainability. Financial sustainability entails the ability for the ICT4D intervention to generate enough income from the recipient community to cover its operational costs post establishment. The link between financial and social sustainability is that these two dimensions are interdependent. Tailoring ICT4D with enough relevant content to realise positive benefit for the target user group impacts its financial sustainability. This is because it inspires local community participation, which in turn generates the neccesary income to support the operations of ICT4D(s) that are not fully funded by local government(s).

To illustrate the relationship between financial and social sustainability, Masiero (2011) makes use of a simple table that describes the inputs and outputs of each dimension, as illustrated in Table 4.3.

Table 4.3 Input and Output definitions of financial and social sustainability of ICT4D interventions

	Financial Sustainability	Social Sustainability
Input	Generate revenue from the intended developing community through the services and products offered by the ICT4D intervention.	The ability to tailor the ICT4D intervention based on the needs of the intended developing community, in order to provide locally relevant content.
Output	The ability to cover operational costs post establishment of the ICT4D intervention.	Inspire increased local participation of the intended user group in the ICT4D intervention.

With reference to Table 4.3, local user engagement and continued involvement helps to build trust with the intended community, and more so when the benefit that they realised is relevant to support the local context. This ensures that users who realise anticipated benefit are retained, while new users are attracted to participate in the ICT4D, thus extending the user base to generate more income and sustaining the ICT4D implementation (Masiero, 2011).

4.2.22 Sustainability in ICT4D according to Mashinini and Lotriet (2011)

The growing popularity of ICT4D implementations in rural areas means that traditional leaders must be engaged to promote ICT4D. Traditional leaders (Kings, Chiefs, Priests, and Headsman) are key role players in the sustainability of rural ICT4D, as their authority and leadership guide the communities that they lead. They should be engaged to act as champions of ICT4D with the intentions of promoting it locally, so as to increase participation and acceptance (Mashinini & Lotriet, 2011).

Mashinini and Lotriet (2011) state that a demonstration of the benefits of ICT-enabled development to traditional leaders, and equipping them with the necessary skills and knowledge, encourage their buy-in. Once this has been achieved, it becomes easier for local rural people to follow in the direction of their leader, whom they regard as someone who has their best interests at heart from a social perspective. In this case, traditional leaders are key stakeholders in achieving ICT4D sustainability in rural settlements, as they encourage local people participation.

4.2.23 Sustainability in ICT4D according to Servaes, Polk, Shi, Reilly, and Yakupitijage (2012)

Sustainability can be achieved by involving the target population in the design and implementation of ICT4D intervention. Furthermore, ICT4D must be made affordable for people in poor and marginalised areas, irrespective of their demographics. The most important actor in ICT-enabled development is the collective target developing community. It is imperative that to benefit their socio-economic needs (e.g., creating employment to alleviate poverty, offering relevant and useful content, reducing crime, and improving literacy) is recognised as the main objective for ICT4D. However, understanding these needs can only occur when local people are engaged to tailor the ICT4D in accordance to the local context. Moreover, for sustainability to be achieved, the ICT4D should have the capacity to adapt to the evolving needs of these local people (Servaes, Polk, Shi, Reilly, & Yakupitijage, 2012).

Servaes *et al.* (2012) also recognise the channel or method that is used to deliver ICT4D as another important factor to consider when implementing ICT-enabled development. People in the subject developing communities are poor and can hardly afford basic needs such as water and food. This raises issues of affordability, depending on the method used to carry out ICT4D interventions. Some ICT4D initiatives are fully donor or government funded and offer free ICT services to the community. However, other ICT4D initiative use a self-funding model and offer ICT services to the public at a fee. This fee represents the necessary income that is required to sustain the operations of the ICT4D intervention and to generate profit as an incentive that motivates various stakeholder within the ICT4D network. Since ICT4D is aimed at improving the lives of local people, affordability issues (in both urban and rural settlements) should be considered for self-funding of an ICT4D intervention, as it impacts sustainability. People should not be deprived just because they cannot afford to participate and, therefore, not benefit from ICT-enabled development.

4.2.24 Sustainability in ICT4D according to Madikiza (2012)

Madikiza (2012) acknowledges that the ICT4D phenomenon has gained popularity in developing regions such as Africa and Asia. However, with this acknowledgement, Madikiza states that a significant amount of ICT4D implementations fail to produce the

intended benefits, which are aimed at empowering poor and marginalised communities. This failure of ICT4D threatens the goal of achieving sustainability in ICT-enabled development.

The implementation of ICT4D is a complex and costly endeavour that requires substantial resource allocation and commitment from the overall stakeholder group. The dynamic nature of ICT is another challenge that affects its sustainability in developing regions. According to Madikizi (2012), some success factors that can prove critical in enabling the sustainability of ICT4D are as follows:

i. **Financial self-sustainability of ICT4D** is key because donor funds may have a finite supply, depending on the willingness and motives of the donor. Various case studies have shown failure of ICT4D interventions post donor involvement, indicating that the reliance on donations is not a sustainable funding mechanism. This explains why ICT4D implementations should have some form of self-funding model, irrespective of donor involvement, to cover the different kinds of costs, including ongoing operational costs.

ii. **Basic Infrastructure** on which ICT interventions depend, such as the supply of electricity, is a cause for concern, especially in ICT4D interventions intended for rural settlements in developing regions. This follows because many rural areas in developing countries do not have access to electricity. Furthermore, electric supply comes at a cost that most people living in these communities cannot afford. Investing in this basic infrastructure should be prioritised prior to the introduction of ICT-enabled development in areas that do not have access to this “must have” commodity.

iii. **Committed Local Leadership** with the vision of achieving sustainability in ICT4D is necessary. Local leadership is key to champion and influence local citizens to participate and see the value of ICT and its impact on their lives. Moreover, from an administrative point of view, leadership will be key to persuade other leaders to get involved, as well as to mobilise the necessary inputs needed by various organisations participating in the ICT4D intervention.

iv. **Transparent Partnerships,** in which stakeholders are made aware of their roles and responsibilities. Understanding and being able to meet each partner's

expectations will aid in continued partner motivation and ensure that partners deliver on their commitments.

v. **The needs of the intended population** should be the foundation for implementing the ICT4D intervention. These needs (including content, skills, and training needs) can be achieved by involving and engaging locals in the design and implementation of the ICT4D. User involvement will help to increase participation and acceptance as people start to realise benefit that is relatable to their circumstances.

vi. **Monitoring and Evaluation of the ICT4D** should become a norm that is used to develop lessons learnt. These lessons learnt will be a significant input to future ICT4D deployments, so that mistakes are not repeated, but rather improved upon, to help achieve sustainability in ICT-enabled development.

4.2.25 Sustainability in ICT4D according to De Zoysa and Letch (2013)

De Zoysa and Letch (2013) argue that the concept of sustainability in ICT4D is not well understood by most ICT4D literature. This can largely be attributed to the complex and dynamic nature of interactions that exist between a variety of components such as people, technologies, institutions, as well as social conditions, to name a few. However, most ICT4D studies present a static view of the sustainability in ICT4D phenomenon by narrowing it to sustainability factors, including economical/financial, social/cultural, political/institutional, technological/technical, and environmental sustainability. It is this limited representation of sustainability in ICT4D that has created a need and an opportunity for ICT4D researchers like De Zoysa and Letch to conduct further research on the phenomenon, which will aid to fully explore and interpret sustainability of ICT4D in the context of the developing community (Walsham & Sahay, 2006).

A significant portion of existing studies define sustainability in ICT4D as the ability of ICT project(s) aimed at achieving socio-economic development to operationally prevail until such time that the project is deemed to have realised the promised socio-economic development obligations. This development realisation is therefore a product of harmony between all sustainability spheres, namely, economic, political, social, technological, and environmental (Heeks, 2002; Kumar & Best, 2006). De Zoysa and

Letch (2013) argue that although this perspective is useful, it is too linear and prescriptive and does not consider the complex and volatile interactions that should be managed in an ICT4D intervention.

De Zoysa and Letch (2013) therefore propose an alternative approach to interpreting sustainability in ICT4D on the basis of Actor-Network Theory (ANT). This approach places emphasises on managing the critical relationships that constitute the ICT4D in relation to time and change. These critical relationships are categorised into global and local network relationships, as can be seen in Figure 4.3. The global network level involves the critical actors that provide the required resources to enable a favourable environment for carrying out an ICT4D intervention, while the local network level includes actors who directly interact with the ICT4D intervention at an operational layer.

Moreover, during the formation of these actor relationships at both the global and local network levels, it is important that the implementation of ICT4D is undertaken with the aim of facilitating sustainability. This entails that all actors understand and commit to their roles and responsibilities, as well as to the rules of engagement. Furthermore, each actor's expectations and motivations should be understood to measure and manage the aspects that might disrupt their enrolment (De Zoysa & Letch, 2013).

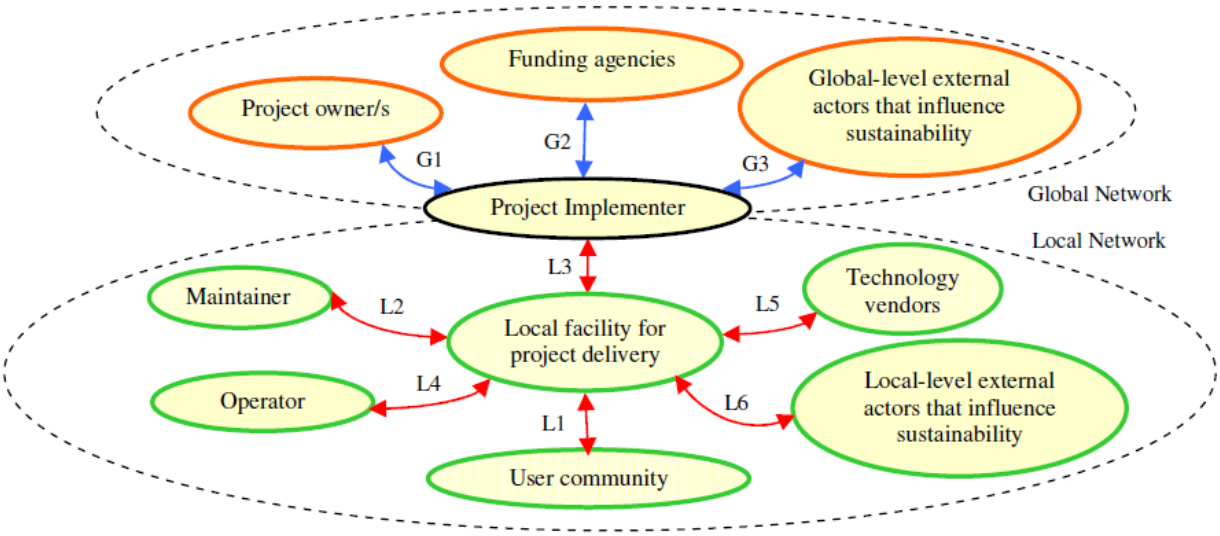


Figure 4.3: *Generic Network for Analysing the Sustainability of ICT4D Projects with a Distributed Architecture (De Zoysa & Letch, 2013:5)*

In essence, De Zoysa and Letch (2013) indicate that the relationships (network) between various tangible and intangible components (actors) — including but not limited to user community, technology (hardware and software), funding agencies, and local government — must be adequately managed in order to achieve ICT4D sustainability. They employ Actor Network Theory (ANT) to illustrate and classify the most critical relationships that are perceived to exist in a typical ICT4D intervention. According to their study, ICT4D sustainability can be realised by evaluating and understanding the critical influencing relationships that exist in an ICT initiative that is intended for social and economic development in the developing community's context. These critical relationships should be viewed as fundamental components that must be monitored and managed over time as they evolve to achieve their sustenance, which is believed to be a prerequisite to realise ICT4D sustainability.

4.2.26 Sustainability in ICT4D according to Nawi, Shukor, Basaruddin, Omar, Rahman, Hassan, and Hassan (2013)

According to Nawi, Shukor, Basaruddin, Omar, Rahman, Hassan, and Hassan (2013), sustainability in ICT4D is a strategic concept that aims to achieve alignment between economic, institutional, and social aspects in the context of developing community. This interpretation of sustainability in ICT4D has been re-emphasised on the basis thereof that it prevails through barriers that hinder sustainability in the design and implementation of information systems. "Sustainability" in this case represents the ability of an ICT intervention, which is intended for development, to maintain operational resilience and achieve the expected socio-economic benefits for local livelihoods during its intended existence (Heeks, 2002).

Nawi *et al.* (2013) interpret sustainability in ICT4D by considering the elements of three significant sustainability dimensions that are understood to influence sustainability, namely, the economic, social/cultural, and institutional dimensions. Each dimension embeds between one and three specific elements that drive or influence the possibility of sustainability in ICT4D when contemplated and carefully adopted, as can be seen in Figure 4.4.

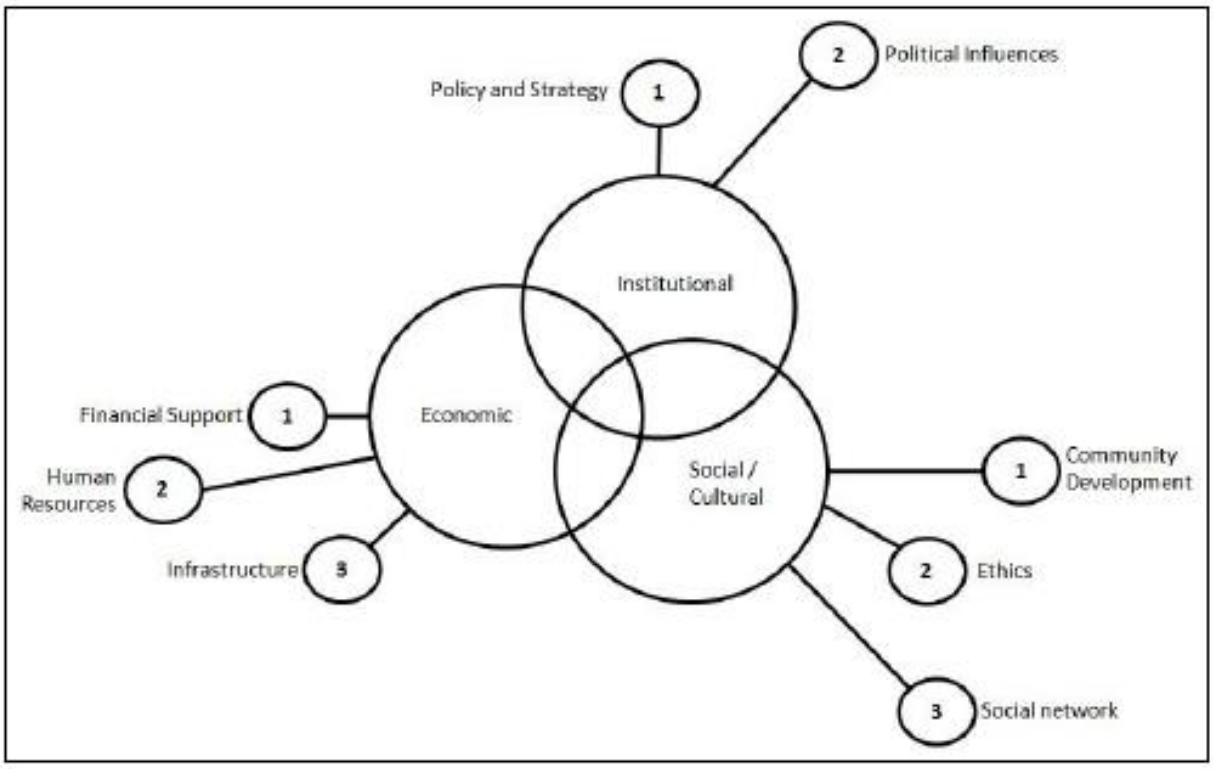


***Figure 4.4**: Proposed ICT Hubs Sustainability Criteria Model (Nawi et al., 2013:4)*

Social/Cultural Sustainability involves aligning ICT4D to the context of the subject developing community, so that people in the target developing community can appreciate and find it easy to accept the local implementation of an ICT initiative. Furthermore, it encourages participation of local people and helps to ensure the successful operation of the initiative, through empowerment that arises from experienced or anticipated social benefits. The social/cultural dimension entails three enabling elements that drive sustainability in ICT4D, namely, community development, ethics, and the social network.

Community Development focusses on improving the community by using ICT as a mechanism that will create equal opportunity for the community to grow. Thus is, for example, facilitated through skills development (e.g., English literacy and computer skills) that enables members of the community to compete in certain markets such as agriculture by gaining access to relevant content. Community development creates a sense of hope and pride that empowers people to participate in the initiative, as well as to assume the well-being of the ICT4D intervention to ensure continuous operations in the long run.

Social/cultural sustainability includes the enabling element known as ethics, which guides local people on the proper usage of the ICT artefacts to achieve the intended development. These guidelines create an awareness for the target population to distinguish between right and wrong when using ICTs, with monitoring capabilities that prevent or halt participation when misconduct is detected. For example, an ICT4D initiative with the purpose of giving internet access to leaners for research purposes should not be compromised by leaners who download irrelevant content such as movies and music videos, as that would be considered as unethical behaviour that negatively impacts the sustainability of the initiative.

The final enabling element of social/cultural sustainability is the social network. This element is about using the internet as a means to bring people together through virtual communication platforms such as email and social media, so that they can share content that is common, based on relations and interactions (Nawi *et al.*, 2013).

Economic Sustainability is the second dimension that incorporates three sustainability enabling elements, namely, financial support, human resources, and infrastructure. Financial support is about the costs involved in running the daily operations of an ICT intervention. These costs vary in nature, and include, for example, purchase and maintenance of equipment as well as salaries of employees. Most financial support of ICT4D are covered by donor agencies such as the World Bank, and by local and international Non-Profit Organisations. In some cases, the ICT4D intervention is designed to self-generate income that will be used to financially sustain itself post donor involvement. Nawi, Shukor, Basaruddin, Omar, Rahman, Hassan, and Hassan (2013) state that proper strategies and sponsorship agreements must be communicated and understood by all ICT4D stakeholders in order to positively influence financial sustainability.

The human resource principle focuses on capabilities and skills of competent internal and external personnel who would provide a particular service within the ICT4D environment. The human resource element is pivotal in the daily facilitation of an ICT initiative to enable consistent operations. It must be acknowledged and incentivised appropriately, as it is a critical aspect of sustainability in ICT4D.

The last enabling element within the economic sustainability dimension is infrastructure. The availability and reliability of ICT infrastructure is an essential attribute in achieving sustainability. It is attained through regular maintenance of hardware, software, and networks to ensure access to the internet and quality of services that promotes user satisfaction. This is necessary so that the target developing community does not become frustrated and abandon participation, should the ICT4D implementation fail to meet their performance demands.

Institutional sustainability represents the final sustainability dimension. Its focus is on policy and strategy, as well as on the management of political influences. Policy and strategy promotes accountability by identifying and defining the roles and responsibilities that help stakeholders to understand and execute their occupation effectively and collaboratively during the operation of an ICT4D initiative. Policy and strategy are essential in developing structures and regulations that assist the ICT4D initiative to consistently perform on the agreed mandate and obligations, which intend to maintain positive socio-economic impact and benefit realisation in the developing community's context.

The second enabling element in the institutional dimension is that of political influence. It aims to complement policy and strategy by promoting accountability from the political sphere. This means that it is important for the governments of developing nations to understand the role that they have to play when undertaking ICT4D implementations. Nawi *et al.* (2013) emphasise that ICT4D initiative(s) should not be used as a political mechanism to promote the governments of developing nations, but rather should be used for the purpose of development within the intended developing community. Furthermore, when political changes occur, or when there is change in government, this transition must not affect the operations of the ICT4D implementation. It must be well presented in policies and strategies and enable adequate regulations that prevent political interference, so that sustainability in ICT4D can be achieved.

4.2.27 Sustainability in ICT4D according to Kisan, Dadabhau, and Singh (2013)

According to Kisan, Dadabhau, and Singh (2013), ICT4D has failed to be sustainable in the past few years because a supplier-driven implementation model was followed.

This means that, since most ICT4D initiatives in developing communities are donor funded, there is minimal to no involvement of the local community during its implementation. Most of these donors are multinationals and humanitarian organisations that are supported by the developed nations who have effectively applied ICT to the benefit of their countries. The notion is that, because the ICT has worked to benefit developed countries, it should work when applied to developing countries without the need to engage the target developing communities. However, this supplier=centric ICT4D approach has proven to be unsustainable.

Kisan *et al.* (2013) state that the technology or finance that is supplied by donors should not be mistaken as the fundamental attribute that enable sustainability in ICT4D. These should instead be understood as secondary requirements, with the human dimension being the primary driver towards achieving sustainability in ICT4D. The human dimension focusses on understanding the needs of the target developing community. This can only be achieved when locals are involved in the design and implementation of ICT4D, to facilitate a tailored intervention that reflects the context of the intended population, who are the actual custodians of the ICT4D.

Therefore, instead of supplier-driven ICT4D, Kisan *et al.* (2013) suggest a demand-driven and multi-stakeholder approach that emphasises the needs of people. There should be monitoring processes in place to ensure that the ICT4D intervention continuously adapts to meet people's changing needs. The evolving expectations and motivations of other participating stakeholders must also be taken into account. It is only through meeting each stakeholder's (donor/sponsor agent, government, and local community) expectations and motivations that sustainability can be achieved, and more so when the needs of the local people are put first.

4.2.28 Sustainability in ICT4D according to Breytenbach, De Villiers, and Jordaan (2013)

Local ownership of ICT4D is a key driver in achieving sustainability. However, achieving local ownership is not easy, because people are only encouraged to participate in the ICT4D implementation when they realise benefit that is related to their needs, or when they are recognised for their efforts for those who participate willingly.

Designing and implementing ICT4D initiatives that are centred around the involvement of local resources promotes local ownership. This enables the sustainability of the ICT4D post donor involvement. The needs of people are aligned with the objectives of the ICT4D, and thus enhances benefit realisation that is closely linked to the context of the host developing community (Breytenbach, De Villiers, & Jordaan, 2013).

4.2.29 Sustainability in ICT4D according to Sanner and Sæbø (2014)

Sanner and Sæbø (2014) view sustainability in ICT4D as the resilience that allows an ICT4D initiative to prolong its operational capacity in the subject community. A number of ICT4D studies have associated the unsustainability of ICT4D interventions with a number of causes, including infrastructure that is not maintained properly, limited financial assistance from local and international donor agencies (e.g., local NGOs, UNICEF, and the United Nations) to cater for the operational needs of the initiative(s), and absence of accountability to ensure that stakeholders produce expected results based on the agreed roles and responsibilities. These are some of the causes of unsustainable ICT4D interventions (Heeks, 2006; Gordon & Hinson, 2007; Ali & Bailur, 2007).

Sanner and Sæbø (2014) state that many donor agencies that fund ICT4D initiatives only provide finite financial support, leading to the project not being able to financially sustain operations due to depleted financial capacity. The participation and interaction between critical stakeholders must be well drafted through strategies and policies, and monitored on a continuous basis, to ensure that roles and responsibilities are well presented, understood, and agreed upon by the stakeholders, based on their positions and capabilities required to enable sustainability in ICT4D. In essence, the existence of institutional sustainability allows for proper functioning and resilience of ICT4D through structure, strategies, and policies that govern and drive the effective execution of an ICT for development initiative, and therefore helps to realise the goal of sustainability in ICT4D.

4.2.30 Sustainability in ICT4D according to Marais (2015)

According to Marais (2015), ICT-enabled development seeks to transform the undesirable social and economic state of a developing community into one that

positively improves local livelihoods. Marais (2015) argues that attention should be given to designing and implementing ICT strategies that are centred on serving the needs of the target developing community from social, economic, and environmental perspectives.

Sustainability in ICT4D depends on numerous interdependent aspects. However, the focus should be on the human development, as it is the foundation for achieving sustainability. The human development aspect emphasises the needs of the local people, who are ultimately the main custodians of ICT4D. This means that ICT4D needs to be relevant and reflective of the local context, to encourage local people's participation (Marais, 2015).

Besides the critical human development aspect, Marais (2015) also acknowledges and describes other sustainability principles. These include financial self-sustainability, institutional sustainability, ICT4D stakeholder relations management, and monitoring and evaluation of ICT4D, as discussed below.

- Financial self-sustainability is about ensuring that the ICT4D implementation does not entirely depend on donor funds. It should be treated as a business that generates income from the local people to support its financial obligations, by offering affordable ICT services and products that are relevant and useful to the developing community’s context.
- Institutional sustainability protects ICT4D by creating rules of engagement. These rules are formulated and presented through structures, policies, and standards that aim to minimise the risk of misuse and vandalism of ICTs that are intended for development.
- ICT4D Stakeholder relationships should be managed on a continuous basis as they evolve. The expectations and motives of these stakeholders, including the local developing community, government officials, private companies, NGOs, and local and international donor agencies must be understood and addressed with a long term view. Each stakeholder’s roles and responsibilities must be well-articulated and agreed upon to enable sustainability. Stakeholder relationships should be flexible enough to encourage new members, and be

resilient to manage the exit of existing members without complications or negative impacts on ICT4D.

- Monitoring and evaluating ICT4D is a change management exercise that allows changes to ICT4D components, including technology, stakeholder relationships, and community needs, to be addressed as they evolve. ICT4D has to embrace this change by providing for it in a manner that does not jeopardise the achievement of sustainability.

4.2.31 Sustainability in ICT4D according to Ochara and Mawela (2015)

Ochara and Mawela (2015) view sustainability in ICT4D from a social lens, stating that local people inclusion is key to the concept of sustainability. This, in turn, requires consideration of the developing community's social context, in order to design and implement a tailored ICT4D intervention. The tailored nature of ICT4D initiative(s) encourages participation and empowers the target population by conforming to, and continuously improving, their needs.

Ochara's and Mawela's (2015) study was aimed at understanding how three elements of ICT-enabled development — including access, skills, and attitude — would socially impact the goal of achieving sustainability in ICT4D, which is perceived as the solution to bridging the digital divide in marginalised communities and to improve their livelihoods from both a social and an economic standing.

Research shows that access to ICT remains a fundamental challenge in developing communities (Ochara & Mawela, 2015), in conjunction to an increase in the usage of technology in parts of developing countries. However, this increased access to technology is not reflective of the ICT4D goals and objectives that aim to utilise ICT as a means of enabling the social and economic development that should be beneficial to impoverished communities. Instead, lack of access to ICT (e.g., durable infrastructure, and uninterrupted network connectivity) is more observable in rural areas, and less so in urban settlements. The issue of ICT access requires careful investment, as well as implementation of strategies and policies that are not prejudiced to the poor and marginalised communities but rather encouraging of their participation by enabling access.

The second social element discussed by Ochara and Mawela (2015) is the lack of skills to participate in ICT-enabled development. Illiteracy is a challenge that poor and marginalised communities in developing countries continue to face. The issue of poverty prevents parents from sending their children to schools in some areas of developing communities, including but not limited to rural settlements and certain urbanised townships. Technical and information skills are mandatory to make ICT4D useful for the target developing community, irrespective of their economic capacity. Therefore, up-skilling of people is another consideration that would positively influence sustainability in ICT for development.

Ochara and Mawela (2015) state “people’s attitudes” towards ICT4D as the last element that impacts sustainability. People’s attitudes may vary depending on their encounter with ICT. This said, people who have realised the benefits of ICT are more likely to have positive attitudes towards ICT4D than those who are yet to experience any form of benefit. The implementation of an ICT4D intervention that is tailored to the needs of the target developing community is essentially what triggers mirroring attitudes. In other words, when people see value and benefit from ICT, they have positive attitudes towards ICT4D. On the contrary, those who do not benefit from ICT are more likely to have negative attitudes or become reluctant towards ICT4D.

4.2.32 Sustainability in ICT4D according to Tanner and du Toit (2015)

ICT4D stakeholders have an important role to play in achieving sustainability. Some of the most important stakeholders include the target community, ICT4D funding agencies, and governments of developing nations. The role that each member plays in ICT4D impacts one or more of the sustainability categories. Furthermore, the relationships that exist between stakeholders play a critical role in achieving sustainability. Implementing ICT-enabled development requires identification and engagement of all critical stakeholders. Each member in the ICT4D partnership should be presented with clear roles and responsibilities. The member must then understand and agree to consistently execute their mandate to enable sustainability (Tanner & du Toit, 2015).

Tanner and du Toit (2015) also state that the ICT4D initiative should be designed and implemented in a manner that is beneficial to local people. In other words, it should reflect the needs of the people from a technical, cultural, and financial point of view. A local ICT4D champion — preferably a community leader or respected person such as a chief, counsellor, or priest — should be appointed to promote ICT4D at a local level. Acknowledging the target developing community as the main stakeholder in ICT4D is a step towards achieving sustainability. However, local people have to derive value from the ICT4D implementation so as to accept and participate in the endeavour. As the needs of people and stakeholder relationships evolve, the ICT4D has to be sufficiently flexible to easily adopt these changes without major implications for sustainability.

4.2.33 Sustainability in ICT4D according to Lennerfors, Fors, and van Rooijen (2015)

ICT4D aims to bring about much needed social and economic development to the lives of people in developing countries, without compromising the wellbeing of the environment (Lennerfors, Fors, & van Rooijen, 2015). For this reason, the implementation of ICT4D should be undertaken with consideration of its effect on the environment. A number of technologies used in ICT has a negative impact on the environment, throughout the process from production to manufacturing, usage, and disposal.

The supply of natural resources such as gold and coltan is a prerequisite for the production of ICT equipment such as laptops and other mobile devices. These natural resources are mined in poor countries, including The Democratic Republic of the Congo (DRC), with destruction of their local environment but with minimal social and economic benefit. This causes anger and conflict (civil war), because only a few elite benefit while the rest of the population struggle daily while seeing that local mineral resources are taken to western and eastern countries that benefit from their manufacturing of ICT equipment.

The manufacturing, usage, and disposal of ICT equipment has a number of other environmental implications, including pollution in the form of electronic-waste (also known as e-waste). According to Lennerfors *et al.* (2015), the majority of e-waste is non-recyclable due to the cost involved in recycling the many different materials that it contains. Consequently, developing countries are seen as an alternative place of disposal for old ICT equipment by developed western countries. However, these ICT donations are seen as good deeds rather than acts of polluting the environment of poor countries, largely in Africa, Asia, and South America.

In order to achieve sustainability in ICT4D, there should be an investment in sustainable ICT. The realisation of social and economic benefit for local livelihoods should not be used as an excuse for destroying the environment. The government of developing countries must protect their environment through the implementation of policy and regulations that aim to protect the environment, while using ICT-enabled development to improve local livelihoods at a social and economic level.

4.2.34 Sustainability in ICT4D according to Manara and Gelderblom (2016)

Manara and Gelderblom (2016) view sustainability in ICT4D according to the elements that influence the five generic sustainability factors discussed in Section 3.4.1. They state that each category of sustainability — including social, economical, institutional, technological, and environmental — is characterised by certain enablers and/or disablers that are specific to the context of the subject developing community. These enablers and disablers impact the five categories of sustainability, and ultimately

sustainability in ICT4D, either positively or negatively. All categories of sustainability need to be sustainable in order to achieve sustainability in ICT4D.

In order to identify the enablers and disablers of sustainability, ICT4D implementations must consider and understand the context of the developing community. This form of due diligence is essential to implement tailored ICT4D(s) that reflect and prioritise the needs of the recipient community. For example, there is no benefit in introducing tablet-based learning into schools in a rural settlement(s) where there is lack of electricity and poor internet connectivity. ICT4D needs to be relevant, and should materialise benefit for the intended developing population. This will improve or accelerate local people's buy-in, which is core to the sustainability in ICT4D (Manara & Gelderblom, 2016).

4.2.35 Sustainability in ICT4D according to da Silva and Fernández (2016)

Da Silva and Fernández (2016) state that, in order to achieve sustainability in ICT-enabled development, all five sustainability categories that constitute the context of a particular society must be satisfied. As discussed in Section 3.4.1, these categories are social, economic, institutional, technological, and environmental sustainability. Each category is impacted by various known and sometimes unknown influencers that may hinder or support its sustainability.

Da Silva and Fernández (2016) identified thirteen factors that enable the sustainability of each category. The number of influencing factors differ across individual categories, depending on the context of the target developing community. Table 4.4 lists and describes all thirteen factors that impact sustainability in ICT4D.

Table 4.4 ICT4D Sustainability Influencing Factors (da Silva & Fernández, 2016:7)

Aspects of Sustainability	Influencing Factor	Impact on ICT4D implementation
Political/institutional related factors	Sponsorship or lack of sponsorship	Strong sponsorships lead to successful ICT4D implementations and sustainability, while lack of sponsorship leads to the opposite results
	Misalignment of goals	The goals of relevant institutions are not aligned to deliver organisational changes required by the ICT4D implementation which results in failed or minimum ICT use
	Alignment/Misalignment of interests	Alignment of interests leads to user acceptance and reduced/low user resistance and successful ICT4D implementation; while misalignment of interests leads to resistance from other actors, disparity in ICT use, unsustainable ICT4D implementation
	Asymmetric relationships between stakeholders	Lack of user involvement, top-down approach, poor contract management, and frequent changes made to the ICTs and conflicting conclusions about the ICT success/failure
Financial/economic related factors	Lack of trust	Donor directly handling the financial transaction of the ICT4D, leads to reduced cooperation between stakeholders. In this case, an ICT4D can be abandoned due to a lack of trust between core stakeholders
	Preferential relationship	Vendor received direct funding from the donor, undermining the importance of the host-institution which may lead to reduced cooperation from the host institution
Technological related factors	Design-reality gap	Gap between technology and reality: the environment, organisational and capacity of the end-users resulted in lengthy project implementation process or unsuccessful ICT4D implementation.
	Lack of technical capacity	Lack of technical capacity to develop, use and maintain the ICT enabled solutions
	User involvement/lack of involvement	Positive results can be achieved when having user involvements in terms of providing inputs and feedbacks to improve the ICT4D. In contrast, lack of involvement may lead to user resistance
Cultural/social related factors	Organisational and national culture	Inefficient cooperation between actors and reduced ICT use and decision making process influenced by cultural background
	Vested interest	Stakeholders vested interests hindering the introduction of ICT4D
	Dysfunctional relationships	Slow ICT4D implementation and higher user resistance
Environmental related factors	Awareness of environmental impacts	ICT4D interventions were delivered with environmental concerns that helped to reduce power consumption and the use of recycled equipment

4.2.36 Sustainability in ICT4D according to Sigweni, Mangwala, and Azerikat (2017)

Sigweni, Mangwala, and Azerikat (2017) studied various features that affect the sustainability of telecentres, and identified nineteen features that collectively impact the sustainability of telecentres. The degree to which these identified features impact the sustainability of telecentres may vary based on the context of operationalisation. In no particular order, the features identified to affect the sustainability of telecentres in developing communities are depicted in Table 4.5:

Table 4.5 Sustainability features of telecentres (Sigweni *et al.*, 2017:4)

#	Features	Description/Motivation
1.	Operation Date	When the telecentre open to the general public
2.	Population	Potential users from catchment area
3.	Funding partners	Source of funds for the establishment of centres
4.	Average Daily Users	Number of patrons received per day (since inception)
5.	Monthly Income (GHS) approx.	Money generated out of the services delivered
6.	Period in operation/closed	How long the facilities have been open to the public (as of the time of interview) or when they closed.
7.	Staff Attrition	Centre manager retention
8.	Computers	The number of available of Pcs for public use
9.	Mechanised Salary	Staff engaged permanently and on payroll
10.	Printing, Photocopy, Secretarial services, Multimedia Services	Working printers, photocopier and Typesetting, video and audio recording, graphic design
11.	IT Training	Provision of IT training to general public
12.	Business Proposal	Support clients to develop business proposals
13.	Internet	Availability of internet services to clients
14.	Power Supply and Backup	Consistent source of electricity
15.	Manager qualification	Educational level
16.	Manager IT Skills	IT proficiency of manager in support of centre needs
17.	Literacy rate	Level of literacy of potential users in the catchment area
18.	Networks/Collaboration	Cooperation amongst telecentres to share ideas and resources
19.	Centre Location	Relative to majority of clients

The features represent the essential requirements of running a telecentre. These requirements relate to various spheres of the developing community, including infrastructure requirements (e.g., source of electric supply, including land and buildings), people resource requirements (e.g., wages and skills development), and connectivity requirements (e.g., availability of internet). Therefore, sustainability in ICT4D is dependent on the effectiveness and efficiency of these various spheres of society, which implies that resources intended for ICT4D should be prioritised according to people's needs. These dynamic needs should be complemented as they

evolve, depending on the impact that ICT4D has on the target developing society (Mangwala, Azerikat, & Sigweni et al, 2017).

4.2.37 Sustainability in ICT4D according to Hosman and Armey (2017)

The study by Hosman and Armey (2017) emphasized technology. Generally, technology is in most ICT4D studies considered as a simple tool that is used as a means of constructing ICT-enabled development. The significance of technology is largely overshadowed by the financial and social sustainability dimensions, which are considered more critical to sustainability in ICT4D. However, Hosman and Armey argue that there is no ICT4D without technology and, because of this, technological sustainability should be given priority as a foundation of ICT4D. The sustainability of technology involves consideration of the costs, durability, availability, and maintainability of the technology, taking into account local capacity in terms of technical knowledge and skills.

Hosman and Armey (2017) state that electricity supply is non-negotiable as a requirement in ICT-enabled development. Technology depends on power to operate, meaning that developing communities that implement ICT for development must have adequate electrical supply to enable the execution of technology and for people to use it. In conclusion, the role of technology, including its dependencies, should not be undermined as it impacts sustainability in ICT4D.

4.2.38 Sustainability in ICT4D according to Mthoko and Khene (2018)

Mthoko and Khene (2018) used an outcome and impact assessment framework to illustrate three components that affect the sustainability in ICT4D. The framework does not indicate the significance, nor does it prioritise its key themes, for an outcome and impact assessment. The aim of the framework is to show interdependencies and relationships that exist between these key themes, because they cannot be viewed or depicted in silos, as doing so would hinder sustainability.

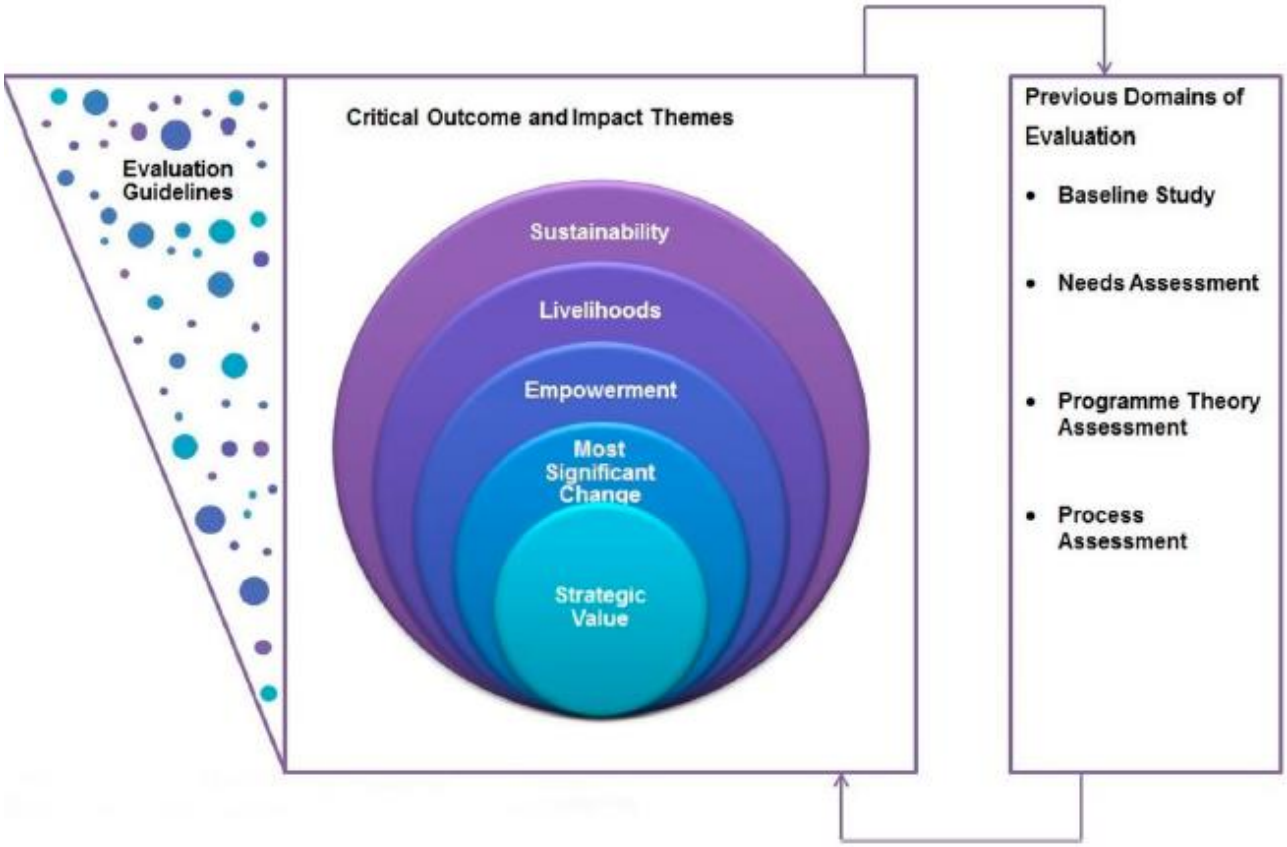


***Figure 4.5**: Proposed outcome and impact assessment framework for Rural ICT4D (Mthoko & Khene, 2018:15)*

The initial component in the framework is referred to as “evaluation guidelines”. These guidelines set the foundation for a tailored ICT4D intervention by guiding ICT4D officials (e.g., sponsors and local authorities) towards understanding the expectations and motivations of every participating stakeholder (more so the target population), the external environment, and ethical issues.

The second component of the framework encompasses key themes of outcome impact assessment that should be contextualised to the intended developing environment. The themes are: strategic value, most significant change, empowerment, livelihoods, and sustainability. The framework does not intend to specify the significance of each theme over the other or to prioritise any theme. Instead, the framework argues that these themes should be contemplated collectively when implementing ICT4D, as these are interrelated and impact each other. Therefore, the core existence of these themes is essentially what drives sustainability in ICT-enabled development.

- **Strategic Value** is about ensuring that the intended objectives of ICT4D are achieved with a positive impact on human development. ICT-enabled development is viewed as a consumer of resources, which could alternatively have been used for other critical social and economic challenges that face the developing community. Therefore, Strategic Value justifies the role of ICT-enabled development by aligning and accelerating it to other spheres within the broader goals of community and human development. In order to position the community and the potential to grow ICT4D, it is important to understand the outcome of the existing intervention and how it has enabled the community to achieve its valued goals. This establishes a foundation that shapes the impact and outcome of the other four themes.
- **Most Significant Change** is closely related to the empowerment and livelihoods themes. It focusses on an open-ended dialogue with the recipient community, so as to understand their interactions and experiences with ICT4D. This information enables the ICT4D implementation to be demand-driven, and to align to the changing needs of the ICT4D recipient community.
- **Empowerment** closely relates to the livelihoods and most significant change themes. This theme emphasises the ability for ICT4D to positively impact the lives of local people. It is this positive impact that grants local people the capacity to create more opportunities for themselves, and therefore making it easy for them to accept the intervention as a means of improving their information, social, and human capabilities.
- **Livelihoods** is closely related to the empowerment and most significant change themes. Parkinson and Ramirez (2006) define livelihoods as the ability of people to establish a living parallel to the context of their developing environment. This theme encourages the intended community to collectively define the livelihoods objectives that are suitable for them in relation to ICT4D. Positive improvement of local livelihoods would enable the developing community to be motivated and encouraged by ICT4D as they continuously realise essential livelihood benefits.
- **Sustainability** should be viewed from the perspective of the outcomes and impacts of ICT4D on the lives of the developing community. Mthoko and Khene (2018) argue that it is not the sustainability of the ICT intervention that is significant, but rather the sustainability of the positively experienced outcome. It

is the combination of outcome and impact of ICT-enabled development that drives sustainability. This means that the benefit realisation that aligns to the needs of the community, and that further creates more opportunity to improve local livelihoods, is what drives sustainability in ICT-enabled development. Thus, sustainability is interrelated to the preceding four themes of the outcome and impact assessment framework, as it provides clarity on whether the positive effect of the other themes are prolonged and do not become unsustainable.

The third and last component of the framework entails the domains for evaluation, which include baseline study, needs assessment, programme theory assessment, and process assessment. Together, these domains provide an understanding of the effects of ICT4D, as well as the components and interactions that drive the ICT4D value chain. Information gathered from all these domains on the basis of the developing community's context enables the implementation of a tailored ICT4D. This form of tailoring should complement the motivations and expectations of various other key stakeholders of ICT4D, especially those of the target developing community.

4.2.39 Sustainability in ICT4D according to Meurer, Muller, Simone, Wagner, and Volker (2018)

Achieving sustainability in ICT4D undertakings depends on various conditions that must be fulfilled. Meurer, Muller, Simone, Wagner, and Volker (2018) identified the most critical conditions that, according to them, "enable" sustainability in ICT for development. These conditions entail understanding the motivations of all stakeholders, commitment from all stakeholders (more so for stakeholders at the macro level of the ICT4D), engagement with the user group in order to implement a tailored ICT4D that is reflective of local people needs based on their societal context, and, lastly, innovation that should come with the conceptualisation of the ICT4D implementation.

Various actors have a role to play in the implementation of ICT-enabled development. These actors have varying motivations for participating in such initiative(s). Some actors may be motivated by an anticipated economic benefit, while other actors (such as the host government) might socially be motivated to improve the livelihoods of its

citizens. However, all stakeholders at both macro and micro level directly or indirectly interact and have an influence on the ICT4D intervention, and meeting their expectations is therefore crucial. Moreover, meeting the stakeholders' expectations helps to improve their commitment towards the intervention. Hence, their participation needs to be carefully managed by ensuring that every stakeholder is aware and accepts their roles and responsibilities to ensure accountability. Stakeholder monitoring is also key, as it can be used to identify the evolution of any changes to stakeholder expectations and relationships, so that adequate action is taken with sustainability in mind (Müller, Simone, Wagner, Wulf, & Meurer et al, 2018).

User group involvement is another key condition that should be addressed during ICT-enabled development. This must be done as a means of fulfilling the needs of the target population by implementing a tailored ICT4D. This will result in the realisation of benefit that is relatable to the target population and, more so, will encourage user acceptance and participation. However, as ICT-enabled development becomes the reality of the host population, their needs may start to change. The ICT4D implementation therefore has to keep up with these evolving needs through innovation that is driven with the consent of every critical stakeholder (Müller, Simone, Wagner, Wulf, & Meurer et al, 2018).

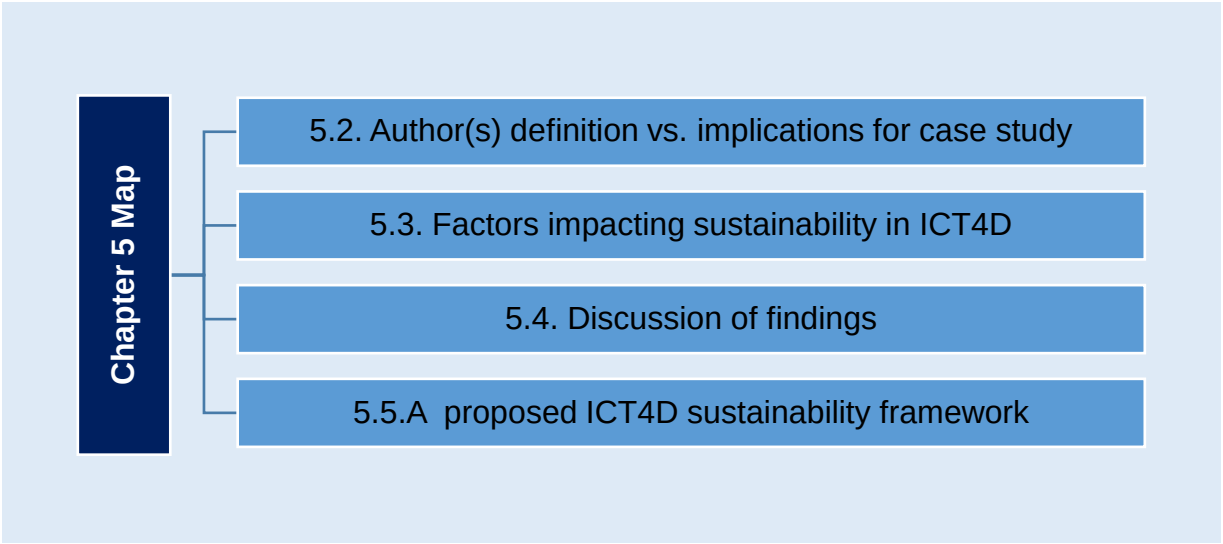
4.2.40 Sustainability in ICT4D according to Barclay, Donalds, and Osei-Bryson (2018)

According to Barclay, Donalds, and Osei-Bryson (2018), the impact that ICT4D has on the lives of the intended developing population is an important element in achieving sustainability. First, ICT4D should cater for the needs of the recipient user group by offering content that is relevant and useful to them. Second, the target user group should be equipped with the basic skills and knowledge that enables them to effectively participate in the ICT4D. Third, people must realise benefit that improves their livelihoods, both socially and economically. Lastly, the ICT4D should be able to adapt to these changing needs, due to the benefit that is realised by local people.

4.3 CONCLUSION

This chapter outlined a detailed literature review of all 40 articles that were selected, based on the methodology presented in Chapter 3. The aim of Chapter 4 was to provide an overview of various ICT4D studies published between the years 2005-2018, and their understanding of what constitutes sustainability in ICT4D initiatives. In summary, the review of articles provides insight into the various factors that constitute sustainability in ICT4D interventions, as understood in the selected articles. Each article was perused in detail to understand how it perceived sustainability in ICT4D, considering its study purpose, employed methodology, and stated research findings. This rigorous perusal process resulted in the above article discussions. The next chapter comprises an analysis of the article discussions, to distinguish and prioritise the various factors that affect sustainability in ICT-enabled development.

5 ANALYSIS OF FINDINGS



5.1 INTRODUCTION

This chapter provides an analysis of the findings and recommendations presented in the 40 selected studies, as discussed Chapter 4. The chapter begins by presenting the meaning of sustainability in ICT4D, based on the author(s) definition, and then comparing it to the outcome of the ICT4D case studies. This is followed by an analysis that aims to determine general enablers and disablers of sustainability in ICT4D, based on the literature review. Furthermore, Chapter 5 identifies the key common views that are perceived to fundamentally enable or disable sustainability in ICT-enabled development, irrespective of context. The analysis of findings contributes to the development of a sustainability framework. The latter is intended to create awareness among all ICT4D stakeholders regarding the critical factors to consider, so that the goal of sustainability and sustained benefit realisation can be achieved during an ICT4D intervention.

5.2 AUTHOR(S) DEFINITIONS VS. IMPLICATIONS FOR CASE STUDIES

Table 5.1 depicts the definition of “sustainability in ICT4D” as perceived by the authors of the selected 40 articles that were discussed in Chapter 4. These definitions are then compared to the case study outcomes in each article, where applicable. The aim of the comparison is to achieve alignment between the author(s) perceptions or theory of sustainability in ICT4D against its application. In other words, the comparison is primarily aimed at validating the applicability of theory in practice. This will also give credibility to the findings presented in this research, because it will indicate that this study is supported by confirmed real life case studies that relate to what constitute sustainability in ICT4D initiatives. Table 5.1 includes the following columns:

i. The first column shows the article number. It matches that of Table 5.2, which extends to a granular level by indicating the individual enablers and disablers of sustainability in ICT4D initiatives for each article. The articles are arranged in a chronological order in both Tables 5.1 and 5.2, from 2005 to 2018.
ii. The second column gives the author(s) definition of sustainability in ICT4D. This definition represents each author(s) understanding or perspective on the phenomenon, based on referenced ICT4D studies and/or personal encounters with ICT4D in general.
iii. The last column illustrates the outcome of the case studies that are described in each article. This column is used to validate the author(s) theory of sustainability in ICT4D against the practical implementations of ICT4D initiatives. Collectively, columns two and three indicate an alignment or misalignment between perceived theories against real life experienced encounters at it relates to sustainability in ICT4D initiatives.

Table 5.1 Article Author(s) Defition vs Outcome of sustainability in ICT4D

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
1	Kumar (2005) defines sustainability in ICT4D through the lens of financial sustainability. Stating that, although the other categories of sustainability in ICT4D are important, the significance of financial sustainability outweighs the other categories because it creates the economic benefit that is required to maintain the operational capacity of the ICT4D intervention. Financial sustainability is key to achieving the economic benefit that improves local people's livelihoods.	The case study presented by Kumar supports his view of financial sustainability as key to achieving the greater efforts of sustainability in ICT4D. The case study illustrates that projects that generated income, regardless of funding model, to cover operational costs (such as employee salaries, maintenance costs, and electricity) and established a profit as gain for relevant stakeholders, continued to be operational. To the contrary projects that did not generate income to cover operational costs ceased operations prematurely.
2	"Sustainability in ICT4D is the intervention's capacity to prevail over time by adapting to the dynamic needs of the recipient community, and ensuring sustained socio-economic benefit realisation for local livelihoods" (Kimaro & Nhampossa, 2005).	Kimaro and Nhampossa (2005) argue the unsustainability of ICT4D in both case studies, as caused by misalignment of ICT4D to the needs of the local user group. Moreover, both case studies employ an up-down approach, where the sponsoring organisations exacted more influence on the ICT4D intervention, with minimal effort on engaging and tailoring the ICT4D to fit the local context and development requirements.
3	Sustainability in ICT4D is the long-term planned development that uses ICT for the target developing community by meeting stakeholder needs, especially those of the recipient community. This can be achieved by placing effort and attention on the involvement of multiple groups and innovative organizational structures, emphasising ICT4D as being people centric, and project resilience that is backed by committed and knowledgeable leadership (Krishna & Walsham, 2005).	The case study presented by Krishna and Walsham (2005) shows that the ICT4D project had committed leadership, was people oriented, engaged multiple stakeholder groups, had organisational structures in place, and was resilient. Together, these enabled the long-term operational capacity of the project for 10 years, until there was change in leadership that led to the abrupt failure of the project (Krishna & Walsham, 2005).
4	Sustainability in ICT4D is the flexibility to negotiate between changing local developing community needs and the broader ICT4D stakeholder group motivations and expectations when implementing ICT4D. This is in order to find common ground that works to the benefit of every participating actor, and more so the	In their case study Jacucci *et al.* (2006) noted that the ICT4D project was able to show signs of sustainability when the development needs of the local user group were prioritised. This act made it possible for the local user group to embrace ICT4D, as they could see the potential value that was relevant to their context.

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
	recipient user group, so that development and sustained benefit realisation can be achieved over time through the use of ICT (Jacucci *et al*., 2006).	
5	Kumar and Best (2006) define unsustainability of ICT4D as poor management of the political and institutional structures that are required to govern ICT4D components such as stakeholder relations and accountability, technology, and change. This leads to failure of the ICT4D intervention to meet the intended goal of socio-economic development and sustained benefit realisation for improving local livelihoods.	The ICT4D project studied by Kumar and Best (2006) was unsustainable due to the lack of political and institutional commitment and governance required to protect and promote the project's existence and sustainability.
6	Kuriyan *et al.* (2006) define sustainability in ICT4D as a balance between social and financial sustainability requirements. These requirements pertain to different expectations and motivations of macro and micro-level actors within the ICT4D network. Therefore, tension between these vast macro and micro-level stakeholder expectations and motivations require trade-offs and prioritisation to meet the development goals of the recipient community, and attain sustained socio-economic benefit realisation through the ICT implementation.	The case study conducted by Kuriyan *et al.* (2006) shows that the failure of the ICT4D was due to its politicised nature. Macro-level stakeholders had their own agendas for implementing ICT4D, which misrepresented the needs of the micro-level stakeholder group. This means that the failure of ICT4D resulted from it being supplier driven, as opposed to being demand driven by first prioritising the social and financial development needs of the recipient community.
7	Ali and Bailur (2007) argue that nothing is sustainable due to the unpredictable nature of future circumstances, as these can positively or negatively impact ICT4D. They view sustainability in ICT4D as a concept of "bricolage", stating that change is inevitable and should therefore be embraced, together with the challenges and opportunities it presents. This implies that ICT4D must be alternated to adapt to changing circumstances that do not reflect original ICT4D expectations.	The concept of bricolage was validated in the two separate case studies, conducted in India and Saudi Arabia. Ali and Bailur noted that the ICT4D projects in both countries were classified as failures and abandoned by critical stakeholders (government and sponsors), regardless of there being financial, social, technological, and political sustainability. However, the projects failed because technology was not used according to its original intention, but rather alternated in a way that presented new opportunity for people to use it differently. This means that local people saw value in using technology differently, as opposed to the original plan of intended use. However,

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
		this sentiment was not shared by sponsors of the project, who then suspended these projects after considering them a failure.
8	Grunfeld (2007) emphasises that sustainability in ICT4D can be achieved when social and economic benefit realisation is experienced by micro-level stakeholders such as local people, business, and communities.	The two case studies resulted in the failure of ICT4D due to the politicised nature thereof, which insisted on a top down approach that excluded prioritising the needs and capacity of the developing communities.
9	Sustainability in ICT4D is triggered by the tailoring of ICT4D to meet the continuously changing needs of people in the target developing community, while being aware of their physical and logical context that may be negatively or positively impacted by the implementation of ICT-enabled development (Gerhan & Mutula, 2007).	In their case study, Gerhan and Mutula (2007) noted that the implementation of ICT-enabled development raised certain expectations and motivations among the local user group. However, when there was frequent interruption of ICT availability for technical and financial reasons, the user community became reluctant to use ICT and to embrace future innovations. This is because ICT4D did not live up to the promised benefit realisation that extends beyond social and economic needs to include user satisfaction and local people empowerment, which is also important to achieving sustainability in ICT4D.
10	Hosman and Fife (2008) define sustainability in ICT4D based on the formation and management of public and private partnerships. They state that sustainability involves a transparent public and private stakeholder ICT4D environment, where each stakeholder's needs, motivations, ability, and capacity for participating in the ICT4D are continuously considered and managed as they evolve towards achieving sustainability.	The case study presented by Hosman and Fife (2008) indicated that proper strong and functional stakeholder relationships between public and private partners were key in enabling the long-term sustainability of the ICT4D project. The developing community was viewed as a major stakeholder to the project, and the implementation of the ICT4D was therefore undertaken using a bottom-up approach to cater for the needs and motivations of all key stakeholders, starting from the ground and navigating up the stakeholder hierarchy.
11	Best and Kumar (2008) define sustainability in ICT4D as a collaborative effort to ensure the consistent supply of four sustainability categories, namely, financial, social, institutional, and technological. The priority and significance of each sustainability category is driven by the context of implementation, and may vary from community to community.	Best and Kumar (2008) noted that ICT4D projects subsidised through financial and technical means remained sustainable for the duration of their implementation. On the other hand, unsubsidised ICT4D projects that were expected to sustain themselves both financially and technically proved to be unsustainable.

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
12	Sustainability in ICT4D is the ability of a project to financially benefit the lives of the developing community, improve their social setting, and protect the environment from damage. This form of benefit realisation should be achieved without compromising the needs of the developing community's future generations, but rather promote continuous positive effects on the lives of local people, regardless of encountered challenges and opportunities (Silivus *et al.,* 2009).	A panel of 14 international experts on ICT4D projects, including academics and practitioners, were selected and interviewed to confirm this definition of sustainability in ICT4D based on their experience and knowledge. Their response indicated that 93% of the experts viewed financial/economic sustainability as the most significant factor, followed by environmental sustainability that had a favourable response of 71%, and social sustainability that was viewed as the third most important, with a favourable response of 57%. The continued benefit realisation or positive impact of these three factors on the developing community was seen by the interviewed experts as the core drivers of sustainability in ICT4D, with more emphasis placed on financial/economic sustainability, as indicated.
13	Pade *et al.* (2009) state that sustainability in ICT4D is about ensuring community development by making use of ICT to create opportunity that continuously realises benefit for the local people at a socio-economic level. However, achieving this development is impacted by certain challenges and opportunities that have to be navigated in order to realise sustained benefit that reflects the needs of the target developing community.	Pade *et al.*'s (2009) definition of sustainability in ICT4D was applied to the Dwesa project, based on its lessons learnt to prove that certain challenges and opportunities need to be navigated through in order to achieve development and sustained benefit realisation that reflects local people's requirements.
14	ICT4D should prioritise the context requirements of the developing community, and continuously reflect the changing needs of the local people in order to realise sustainability (Bailey, 2009).	The various stakeholders interviewed in the case study, including sponsors, local government, technology partners, and the target community user group, collectively confirmed that the success of the ICT4D project was derived from it being demand driven. This means that the implementation of ICT4D prioritised the changing needs of the target population by using a bottoms-up approach that also takes into secondary account the expectations and motivations of other critical stakeholders that make up the ICT4D network (Bailey, 2009).

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
15	"Sustainability in ICT4D is the permanence of a flow of benefits within the system, after the development project has ended and the external funding is extinguished" (Brunello, 2010).	None
16	According to van Rensburg *et al.* (2010), sustainability in ICT4D is putting the dynamic development needs of the target community before the expectations and motivations of other stakeholders in the ICT4D network. Moreover, it should be ensured that the ICT4D implementation is guided by strong institutional structure and values to achieve sustainability.	Through observations and interviews with various actors in their case study, van Rensburg *et al.* (2010) established that the success of the project resulted from a collective stakeholder group that worked as a team to achieve development in the recipient community, guided by shared principles and goals that prioritise the changing needs of local people and followed by expectations and motivations of other stakeholders within the network.
17	Marais (2011) understands sustainability in ICT4D as related mostly to the concept of human scale development. This implies that sustainability is the process of improving the lives of local people through ICT, and ensuring that the requirements as well as the motivations of other critical stakeholders are also satisfied to enable their continued participation in ICT4D.	Marais identified two case studies that employed the concept of human scale development in order to achieve sustainability. The case studies proved that alignment of stakeholder interests, translated via a bottom-up approach, was the main driver for achieving the sustainability of these projects. Moreover, meeting the stakeholder interests promoted participation and created a sense of commitment to stakeholder roles and responsibilities within the ICT4D network.
18	Hosman (2011) state that sustainability in ICT4D is about enforcing a demand-driven approach to ICT4D implementations. This ensures that the needs of people are put first and managed as they change, and to adapt the ICT4D implementation accordingly.	Although the Sri Lankan project studied by Hosman (2011) was characterised by certain challenges and opportunities, it was determined that the core requirement for enabling sustainability was to ensure that the needs of local people are initially catered for. A committed stakeholder group was the secondary requirement for achieving sustainability in the ICT4D.
19	Vaughan (2011) defines sustainability in ICT4D as a collaborative effort between the various stakeholders that make up the ICT4D, more specifically engaging the target community to understand their needs and capabilities to continuously tailor the design and implementation of ICT4D according to evolving people needs.	Vaughan (2011) considered two ICT4D case studies implemented in two Australian communities. The one case study proved to be sustainable, as it used ICT to enable the well-being of the community based on their needs and capabilities. On the other hand, the other ICT4D project failed because it merely provided the ICT resource without understanding the needs and capabilities of the community,

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		leading it to being neglected by local people as they see no value in the ICT resource provided.
20	Sustainability in ICT4D ensures that the target developing community continues to experience social and economic benefit that improves local livelihoods. The benefit realised is not a once-off encounter, as it requires adaptation to the changing needs of people in relation to the community context as these evolve due to the impact of ICT-enabled development (Pade-Khene *et al.*, 2011).	Pade-Khene *et al.* (2011) compared two ICT4D projects and noted that, of these two, the project that demonstrated a demand-driven approach was more successful in achieving sustainability. On the contrary, the other project failed to incorporate the target user community needs, and was less successful.
21	Masiero (2011) defines sustainability in ICT4D based on the relationship between social and financial sustainability, stating that social sustainability can be ensured by engaging local people to tailor ICT4D to reflect the changing needs and context of the developing community, so that local people can continue to realise relevant benefit that will enable them to participate and accept the ICT4D intervention. This participation, in turn, is necessary to generate the required revenue to financially sustain the intervention's operations.	In the case study, Masiero (2011) states that the ICT centres that were focussed on offering relevant content, which was innovative and tailored to meet the evolving requirements of the recipient user group through continuous engagement and trust building, generated enough profit from operational income to sustain the ICT4D intervention. On the contrary, ICT centres that were not user-centric and that provided outdated services and features failed to generate the required income to maintain the operational capacity of the ICT centre.
22	Sustainability in ICT4D largely depends on an understanding of the interaction that exists between ICT4D interventions within the social context at the local community level. This is essential to drive participation and acceptance of the ICT4D intervention by localising it for relevant social and economic benefit (Mashinini & Lotriet, 2011).	The case study conducted by Mashinini and Lotriet (2011) shows that traditional leadership in rural areas is key towards achieving sustainability. This is because, when ICT policy and implementation is deemed a low priority by traditional leaders, it can affect participation and acceptance from rural people, especially when their national or local government is limited in terms resource capacity from an ICT policy and project perspective.
23	Servaes *et al.* (2012) define sustainability in ICT4D as using ICT to enable continued development that is managed over time to meet the changing social and economic needs of the recipient community.	Servaes *et al.*'s (2012) case studies showed that demand-driven ICT4D projects that involved the target user group in the design and implementation of the ICT4D were more successful when compared to those that did not. This is because projects that involved the user

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
		community were financially and technically tailored to be relevant to the context of the developing community, as opposed to projects that did not reflect the needs of the target user group, which eventually led to their failure.
24	Sustainability in ICT4D is the continued or uninterrupted benefit realisation that socially and economically improves livelihoods in the target developing community through the use of ICT (Madikiza, 2012).	None
25	De Zoysa and Letch (2013) state that sustainability in ICT4D depends on the management of critical relationships and partnerships that form part of the ICT4D implementation. These stakeholder relationships exist at different levels, and can therefore be prioritised based on their criticality and impact towards achieving sustainability in ICT4D.	In their case study, De Zoysa and Letch (2013) made use of the Actor Network Theory (ANT) to identify and verify the critical stakeholders at global and local level who collectively enabled sustainability. All the identified stakeholders collectively and individually had a role to play in ensuring success of the ICT4D. Therefore, sustainability in ICT4D can be achieved through committed and strong stakeholder relations that understand and adhere to their roles and responsibilities, while continuing to be motivated.
26	Sustainability in ICT4D is enabled by eight elements that are categorised between three sustainability dimensions of ICT4D. The dimensions and their respective elements are economic sustainability (financial support, human resources, and infrastructure), institutional sustainability (policy and strategy and political influence), and social sustainability (community development, ethics, and social network) (Nawi *et al.,* 2013).	The definition of Nawi *et al.* (2013) is based on interviews conducted with participants who have experienced ICT4D first-hand and who were able to identify the elements that worked well in ensuring sustainability in ICT4D.
27	Kisan *et al.* (2013) state that sustainability in ICT4D is about following a demand-driven approach as opposed to a supplier-driven approach. This means that the needs and context of the target developing community are prioritised and managed as they evolve. However, this does not mean that the expectations and motivations of other stakeholders should be neglected, but rather	The documents reviewed by Kisan *et al.* (2013) confirm that most projects that did not involve the target user groups had a greater chance of failing, as opposed to projects that understood and prioritised the changing needs of the intended developing community.

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
	embraced and managed to create a broader collaborative stakeholder network effort.	
28	Sustainability in ICT4D is applying ICT to achieve a form of benefit realisation that reflects the needs of the local population over time. This drives local ownership and acts as a critical requirement that enables sustainability in ICT4D (Breytenbach *et al.,* 2013).	The case study shows that the inclusion of local people is key to achieving sustainability. This is because understanding the needs of the user group is critical to continually achieve the benefit realisation that is reflective of their reality. Therefore, promoting local ownership that enables participation and acceptance of the ICT4D is key to its sustainability (Breytenbach *et al.*, 2013).
29	Sanner and Sæbø (2014) define sustainability in ICT4D as the resilience that enables an ICT4D initiative to prolong its operational capacity in the subject developing community.	In order to achieve resilience of ICT4D, Sanner and Sæbø (2014) suggested that institutional logic be used to have stakeholder's commit to their roles and responsibilities, and to promote accountability. This is because, in their case study, it was noted that the project failed soon after donor involvement. Therefore, designing and implementing proper institutional structures such as policies and strategies can enable the project to have proper measures in place that will ensure resilience of the project, regardless of unforeseen circumstances such as an exit of donor support.
30	Marais (2015) defines sustainability in ICT4D as a systems concept that is characterised by various interacting components, including people, public and private organisations, technology, and the physical environment, to name a few. These components are exposed to change that brings with it certain challenges and opportunities as they evolve within the ICT4D landscape. Therefore, resilience and continuous monitoring and management of the ICT4D landscape is necessary to achieve sustainability.	Marais (2015) does not apply a case study to prove this definition of sustainability in ICT4D. However, he states that sustainability is a product of multiple interacting factors within the ICT4D landscape that should be understood and managed, using established and agreed requirements, including expectations.
31	Ochara and Mawela (2015) view sustainability in ICT4D from a social lens, stating that local people inclusion is key to the concept of sustainability in ICT4D. Local people inclusion, in turn, requires consideration of the developing community's social and economic context, in order to design and implement a tailored ICT4D	The results of the case study shows that poor and marginalised communities show positive signs in wanting to embrace ICT as a tool that could lead to development. However, to drive sustainability, collaboration between key stakeholders (such as governments and sponsors of ICT4D) is required to design strategies and structures

#	Author(s) Definition of Sustainability in ICT4D	Implication of ICT4D based Researcher(s) definition
	intervention that will help realise relevant benefit that leads to sustainability.	that will focus on implementing ICT4D, based on the needs of the developing community, to support their social and economic context
32	Tanner and du Toit (2015) state that sustainability in ICT4D is about maintaining stakeholder relationships using a bottom-up approach that puts the needs of the target developing community before other critical stakeholders within the overarching ICT4D network. However, the motivations and expectations of the broader stakeholder group also need to be addressed. Each stakeholder must agree to be held accountable to their allocated roles and responsibilities. Moreover, monitoring mechanisms must be implemented to manage the stakeholder network as it evolves.	Based on their case study, Tanner and du Toit (2015) identify the following areas that promote sustainability in ICT4D: - A shared stakeholder belief and vision about the role and purpose of ICT4D-promoted sustainability. - Prioritising the needs of the target developing community, and viewing it as the primary critical stakeholder, promotes sustainability in ICT4D. - Ensuring that overall stakeholder group expectations and motivations are well managed as they evolve and ensure accountability of their roles and responsibilities, based on their capacity to participate in the ICT4D.
33	Lennerfors *et al.* (2015) state that sustainability in ICT4D is using ICT effectively to socially and economically improve local livelihoods in developing communities without compromising the well-being of their environment. Therefore, the use of sustainable ICT is required to achieve sustainability in ICT4D.	None
34	Manara and Gelderblom (2016) state that collective sustainability in all the general sustainability categories (social, financial, institutional, technological, and environmental), based on the context of the target developing community, and must exist to achieve sustainability in ICT4D.	Manara and Gelderblom (2016) attribute the unsustainability of the ICT project that they studied to the lack of sustainability in one or more of the general sustainability categories. This means that sustainability in ICT4D depends thereon that all general categories are harmoniously sustainable.
35	Da Silva and Fernández (2016) state that sustainability in ICT4D can be achieved by satisfying the five categories of sustainability, namely, social, financial, institutional, technological, and environmental sustainability.	None
36	Sigweni *et al.* (2017) argue that sustainability in ICT4D is based on the design and actuality gap that exists in interventions.	The failure of ICT4D in their case study was a result of misalignment between design and actuality of the ICT4D implementation.

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	Therefore, when the implementation of ICT4D mimics its design requirements (including people, infrastructure, and connectivity requirements), then sustainability can be achieved.	Necessary strategies and policies are needed to create structures that will drive the alignment between design and actuality of ICT4D implementations (Sigweni *et al.*, 2017).
37	Hosman and Armey (2017) define sustainability from a technological sustainability lens, by stating that the uninterrupted operation of technology, including its affordability and continued supply of electricity, are fundamental towards achieving sustainability in ICT4D and promoting accessibility of technology for people to realise socio-economic benefit.	None
38	Sustainability should be viewed from the perspective of an assessment of the ICT4D outcome and impact on the lives of the developing community. It is the combination of outcome and impact of ICT-enabled development that drives sustainability. This means that benefit realisation that aligns to the needs of the target developing community, and further creates the opportunity to improve local livelihoods, is what drives sustainability in ICT-enabled development (Mthoko & Khene, 2018).	None
39	Sustainability in ICT4D can be achieved through proper management of stakeholder expectations and motivations. The management entails development of an understanding of all stakeholder expectations and motivations to tailor the ICT4D to the benefit of every involved stakeholder. Moreover, ensure that stakeholders are aware and committed to their roles and responsibilities. The primary stakeholder should be the developing community itself and, therefore, local people's needs should be prioritised for fulfilment, primary to those of other stakeholders (Meurer *et al.,* 2018).	None
40	Barclay *et al.* (2018) define sustainability in ICT4D as the continuous adoption of ICT initiatives by local people as a result of	Although the ICT4D case study conducted by Barclay *et al.* (2018) is still in the pilot phase, it was noted that the perceived ease of use

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	the continued experience of social and economic benefit realisations that improve local livelihoods.	and usefulness of the ICT4D were major contributors to the adoption of the ICT4D projects. This was achieved based on aligning the ICT4D to the expectations and motivations of the target user group. This implies that continuous engagement with the target user community in the design and implementation of ICT4D is important in realising the relevant benefit that continuously meets the needs of the target user group.

5.3 FACTORS INFLUENCING OR IMPACTING SUSTAINABILITY IN ICT4D

Table 5.2 is a summary of all the factors that are perceived to affect sustainability in ICT-enabled development. The table structure comprises the following five columns:

i. The first column shows the article number, as represented in the literature review section (Chapter 4) of this study, and indicates that a total of 40 unique articles contributed to this study.
ii. Column two is a citation of the article. It includes the surname(s) of the author(s) and the year that the study was published. The studies are presented in chronological order (from the oldest to the most recent articles) over the in-scope period of this study (2005-2018).
iii. The third column is a reference to the relevant section of Chapter 4, where the findings and recommendations of each article were discussed in detail. This column allows for ease of navigation for the reader.
iv. The fourth column outlines the actual factors that are perceived to enable or disable the sustainability in ICT-enabled development. These factors are stated relative to the context and objectives of each chosen article.
v. The fifth column categorises each identified factor in column four as either an enabler or disabler of sustainability, as depicted in the chosen article. Enablers are highlighted in green because they are considered to have a positive impact on sustainability, while disablers are highlighted in red due to their perceived hindrance to sustainability efforts in ICT4D.

Table 5.2 Factors influencing the sustainability of ICT-enabled development

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
1	Kumar (2005)	4.2.1	financial sustainability using a self-funding model to cover ICT4D costs	enabler
2	Kimaro and Nhampossa (2005)	4.2.2	inadequate infrastructure	disabler
			inadequate local human capacity	disabler
			fragmented donor policy	disabler
			lack of policies and strategies	disabler
			need to institutionalise ICT4D	enabler
3	Krishna and Walsham (2005)	4.2.3	committed and knowledgeable leadership	enabler
			involvement of multiple user groups	enabler
			organisational structures	enabler
			people orientation	enabler
			ability for ICT4D to be resilient	enabler
4	Jacucci, Shaw, and Braa (2006)	4.2.4	limited donor funding	disabler
			absence of local human development	disabler
			stagnant ICT4D implementations that do not accelerate development	disabler
			focus on local capacity building (skills and infrastructure development)	enabler
			ability for ICT4D interventions to adapt to changing people needs	enabler
5	Kumar and Best (2006)	4.2.5	inadequate local soft and technical skills and lack of training	disabler
			lack of committed and knowledgeable leadership	disabler
			inability to manage change resulting from ICT4D implementation	disabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
6	Kuriyan, Toyama, and Ray (2006)	4.2.6	benefit realisation on a needs basis for all stakeholders participating in the ICT4D intervention	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D intervention	enabler
7	Ali and Bailur (2007)	4.2.7	inability to adapt to changes in technology	disabler
			limited financial resources	disabler
			inadequate local soft and technical skills and lack of training	disabler
			limited or no user community buy-in	disabler
			lack of policies and strategies	disabler
			bricolage (evolving and adapting to unplanned change)	enabler
8	Grunfeld (2007)	4.2.8	benefit realisation on a needs basis for all stakeholders participating in the ICT4D	enabler
			managing stakeholder (macro, meso, and micro level) expectations and understanding their motivation(s) for participating in the ICT4D	enabler
			collaboration and inclusion of all key ICT4D stakeholders	enabler
9	Gerhan and Mutula (2007)	4.2.9	inadequate infrastructure	disabler
			illiteracy	disabler
			crime	disabler
			poverty	disabler
			strict traditions that are against modernisation	disabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			need for financial sustainability	enabler
			community context evaluation (including consulting community members) to tailor ICT4D interventions on a needs basis	enabler
10	Hosman and Fife (2008)	4.2.10	management of public-private partnerships in terms of expectations and motivations including those of the developing community	enabler
			local community inclusion to allow for a tailored ICT4D intervention that reflects the needs of intended population	enabler
11	Best and Kumar (2008)	4.2.11	lack of technical support	disabler
			lack of financial self-sustainability	disabler
			offering relevant content to the community	enabler
			local community buy-in	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D	enabler
12	Silivus, Van Den Brink, and Smit (2009)	4.2.12	local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D	enabler
			protection of the developing community's environment	enabler
13	Pade, Mallinson, and Sewry (2009)	4.2.13	ICT4D must have a simple and clear objective	enabler
			ICT4D must take a holistic approach	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
			using ICT to increase existing community development activities	enabler
			having a local ICT4D champion	enabler
			including socially excluded groups	enabler
			design and communication of ICT4D policy	enabler
			knowledge of local political context	enabler
			encouraging participation of community target groups	enabler
			a focus on local/demand-driven needs	enabler
			building on local information and knowledge systems	enabler
			appropriate training and capacity building	enabler
			facilitating local content development	enabler
			motivation and incentive for ICT job placement in the developing community	enabler
			a focus on economic self-sustainability (Entrepreneurship)	enabler
			encouraging local ownership	enabler
			form of local partnerships	enabler
			choosing appropriate technologies	enabler
			building on existing public facilities	enabler
			frequent monitoring and evaluation of ICT4D interventions	enabler
14	Bailey (2009)	4.2.14	local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler
15	Brunello (2010)	4.2.15	local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler
16	van Rensburg, Cronje, and du Buisson (2010)	4.2.16	local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D intervention	enabler
			formulating and agreeing to roles and responsibilities by stakeholder and holding them accountability	enabler
17	Marais (2011)	4.2.17	local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
18	Hosman (2011)	4.2.18	demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
			formulating and agreeing to roles and responsibilities by stakeholder and holding them accountability (to ensure stakeholder commitment)	enabler
19	Vaughan (2011)	4.2.19	demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D intervention	enabler
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler
20	Pade-Khene, Mallinson, and Sewry (2011)	4.2.20	demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler
			piloting ICT4D to establish ground and create awareness	enabler
21	Masiero (2011)	4.2.21	demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			financial sustainability - using a self-funding model to cover ICT4D costs	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
22	Mashinini and Lotriet (2011)	4.2.22	engaging local leadership (such as Kings, Chiefs, Priests, and Headsman) to become champions of ICT4D interventions	enabler
			appropriate training and capacity building	enabler
23	Servaes, Polk, Shi, Reilly and Yakupitijage (2012)	4.2.23	demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D interventions	enabler
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler
			ICT4D must be affordable	enabler
			financial sustainability - using a self-funding model to cover ICT4D costs	enabler
24	Madikiza (2012)	4.2.24	financial sustainability - using a self-funding model to cover ICT4D costs	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D intervention	enabler
			local capacity building (infrastructure development)	enabler
			local community inclusion to allow for a tailored ICT4D intervention that reflects the needs of intended population	enabler
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler
			committed and knowledgeable leadership	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
25	De Zoysa and Letch (2013)	4.2.25	managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D network and holding them accountable	enabler
			monitoring and managing stakeholder relationships as they evolve	enabler
26	Nawi, Shukor, Basaruddin, Omar, Rahman, Hassan, and Hassan (2013)	4.2.26	Community development	enabler
			Ethics	enabler
			increasing social networks	enabler
			requirement of knowledgeable ICT4D human resources	enabler
			financial sustainability - using a self-funding model to cover ICT4D costs	enabler
			local capacity building (infrastructure development)	enabler
			clearly defined and agreed policy and strategy by all involved stakeholders	enabler
			committed and knowledgeable leadership	enabler
27	Kisan, Dadabhau, and Singh (2013)	4.2.27	lack of community involvement in the design and implementation of ICT4D interventions	disabler
			demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			ICT4D monitoring and evaluation in order to adapt to changing people needs	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D intervention	enabler
28		4.2.28	promoting local ownership of ICT4D interventions	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
	Breytenbach, De Villiers, and Jordaan (2013)		demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
29	Sanner and Sæbø (2014)	4.2.29	inadequate infrastructure	disabler
			lack of financial sustainability	disabler
			lack of stakeholder accountability	disabler
			clearly defined and agreed policy and strategy by all involved stakeholders	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D network and holding them accountable	enabler
30	Marais (2015)	4.2.30	demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
			financial sustainability - using a self-funding model to cover ICT4D costs	enabler
			clearly defined and agreed stakeholder roles and responsibilities to encourage accountability	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D network and holding them accountable	enabler
			ICT4D monitoring and evaluation	enabler
31	Ochara and Mawela (2015)	4.2.31	demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			lack of capacity building (skills and infrastructure development)	disabler
32	Tanner and du Toit (2015)	4.2.32	clearly defined and agreed stakeholder roles and responsibilities to encourage accountability	enabler
			managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D network and holding them accountable	enabler
			demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler
33	Lennerfors, Fors, and van Rooijen (2015)	4.2.33	sustainable ICT that protects the environment from harm	enabler
34	Manara and Gelderblom (2016)	4.2.34	demand-driven ICT4D by understanding the local context	enabler
35	da Silva and Fernández (2016)	4.2.35	lack of strong sponsorship and/or self-sustainability	disabler
			misalignment of ICT4D goals with motivations of stakeholders	disabler
			lack of developing community leadership involvement	disabler
			lack of trust between ICT4D donors and local community officials	disabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
			preferential relationships in the ICT4D network that undermines other stakeholders	disabler
			design and actuality gaps of technology	disabler
			damage to the environment	disabler
			user resistance	disabler
			lack of cooperation between stakeholders in the ICT4D network	disabler
			lack of local technical capacity	disabler
36	Sigweni, Mangwala, and Azerikat (2017)	4.2.36	managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D network and holding them accountable	enabler
			local capacity building (skills and infrastructure development)	Enabler
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	Enabler
			financial sustainability - using a self-funding model to cover ICT4D costs	enabler
37	Hosman and Armey (2017)	4.2.37	local capacity building (infrastructure development)	enabler
			sustainable access to ICT	enabler
38	Mthoko and Khene (2018)	4.2.38	managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D network and holding them accountable	enabler
			demand-driven ICT4D by involving the community in the design and implementation of ICT4D interventions	enabler

#	Article Author(s)	Chapter 4 Literature Review Link	Key Findings (Factors Affecting ICT4D Sustainability)	Enabler/Disabler Factor
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			ICT4D monitoring and evaluation	enabler
39	Meurer, Muller, Simone, Wagner, and Volker (2018)	4.2.39	managing stakeholder expectations and understanding their motivation(s) for participating in the ICT4D network and holding them accountable	enabler
			demand-driven ICT4D by involving the community in the design and implementation of ICT4D intervention	enabler
40	Barclay, Donalds, and Osei-Bryson (2018)	4.2.40	demand-driven ICT4D by involving the community in the design and implementation of ICT4D intervention	enabler
			local community social and economic benefit realisation to attract community buy-in and participation in the ICT4D intervention	enabler
			ICT4D monitoring and evaluation to assess and adapt to changing people needs	enabler

Overall, the 40 selected articles provided critical information about how sustainability in ICT4D is perceived in literature. The information provided by these articles mostly differed in terms of the context in which the study was conducted. However, from a holistic point of view, the findings of these chosen articles reflect a shared generic understanding about some of the key factors affecting sustainability in ICT-enabled development.

5.4 DISCUSSION OF FINDINGS

5.4.1 Findings Analysis

The researcher noticed that the majority of the chosen articles focussed their findings and recommendations on indicating the key enablers of sustainability in ICT4D. Enablers are considered as factors that, when achieved, can help realise sustainability in ICT4D. On the other hand, only a small number of articles focussed on sustainability disablers. Disablers are considered to be factors that hinder sustainability, also known as barriers or challenges that would prevent the realisation of sustainability in ICT4D. Some articles took a hybrid presentation by communicating their findings and recommendations using both enablers and disablers. Table 5.3 categorises the 40 chosen articles based on the study's illustration or discussion of sustainability in ICT4D.

Table 5.3 Categorisation of Articles

Article Categorisation Table		
#	**Study Discussion Focus**	**Number of Articles**
1	ICT4D enablers only (positive factors)	30
2	Disablers only (barriers/challenges)	2
3	Hybrid message (combining enablers and disablers)	8
	Total Number of Articles	**40**

5.4.2 Enablers of Sustainability in ICT4D

A total of 30 studies addressed only the enablers of sustainability in ICT4D. A further eight articles discussed enablers in conjunction with disablers of sustainability in ICT4D. This means that, of the chosen 40 articles, a total of 38 articles presented

findings and recommendations that relate to how sustainability in ICT-enabled development can be achieved. Table 5.4 depicts factors that were identified in more than one article as enablers of sustainability in ICT4D.

Table 5.4 Common Enablers (success factors) of Sustainability in ICT4D

#	Description of Recurring Enablers	Supporting Number of Articles (max = 38)	Article Percentage Representation
1	understanding and managing (includes monitoring and evaluation) all stakeholder motivations, expectations, and relationships	22	58
2	formulating, communicating, and agreeing to stakeholder roles and responsibility to ensure accountability	22	58
3	local community buy-in	21	55
4	demand-driven ICT4D that reflects the needs of the intended community	20	53
5	inclusion of local people in the design and implementation of ICT4D	20	53
6	local social and economic benefit realisation	20	53
7	ICT4D impact monitoring and evaluation	13	34
8	ability for ICT4D to adapt to evolving people needs	10	25
9	need for ICT4D financial self-sustainability	9	24
10	local capacity building (skills and infrastructure development)	9	24.5
11	clearly defined and communicated ICT4D policy and strategy	6	16
12	promotion of local ICT4D ownership	4	12
13	committed and knowledgeable leadership	3	8
14	environmentally friendly ICT4D implementations	2	5
15	increased social network and inclusion of socially excluded groups	2	5
16	ICT4D must be resilient and take a bricolage approach	2	5

Figure 5.1 graphically illustrates the percentage of each enabler as represented in the number of articles identified. The calculation was based on the following formula:

$$Enabler\ Percentage\ (\%) = \frac{Visible\ Number\ of\ Articles}{Max\ Number\ of\ Articles} * 100$$

Visible Number of Articles is the actual number of articles in which the enabler was identified. **Max Number of Articles** is the total possible number of articles in which the enabler could have been identified. In total, there were thirty-eight (38) articles in which each enabler could have been possibly identified. Therefore, the visible number of articles is divided by the maximum number of possible articles, and then multiplied by the number **100** to express the value as a percentage.

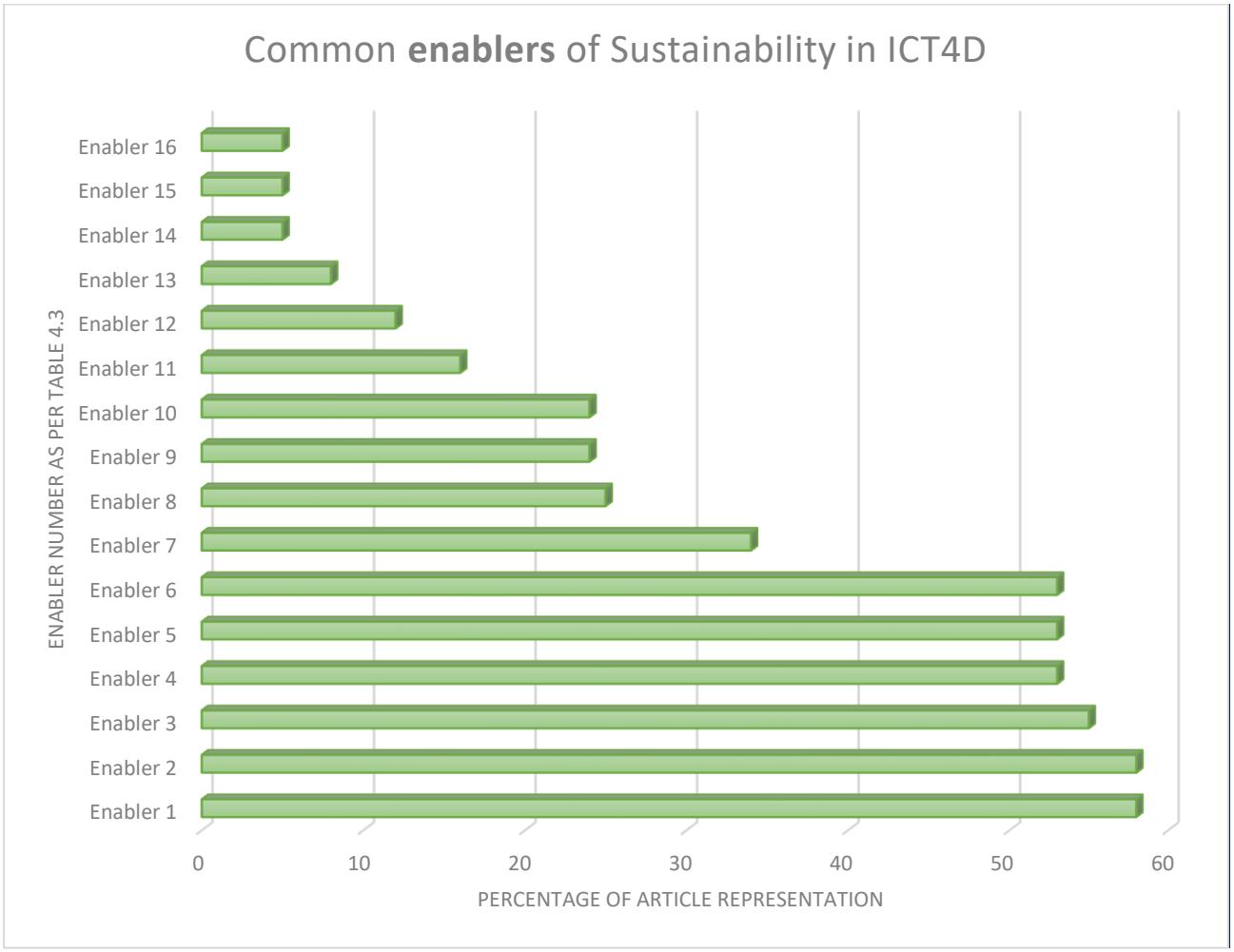


***Figure 5.1**: Common enablers of Sustainability in ICT4D*

Each enabler had to be identified at least more than once in the possible 38 articles in order to be acknowledged as a common or shared view of understanding towards sustainability in ICT4D. This means that Table 5.4 comprises only enablers that were identified in two or more articles. In total, 16 enablers conformed to this criteria, as can

be seen in the specified table. The enablers are arranged from one to 16, with the first enabler having been identified the most in the selected articles, while the last is the least identified enabler.

Table 5.5 maps these enablers to the general sustainability category that they represent. This gives a picture of which sustainability category needs to be enabled the most and the least in order to achieve sustainability in ICT-enabled development. This representation is based on the perceptions presented by the authors of the chosen ICT4D literature.

In total, 16 enablers were identified as shared views in literature. The data shows that seven of the 16 enablers fully represented the political/institutional sustainability category. The last enabler that speaks to resilience and bricolage touched on all the sustainability categories. Therefore, seeing that there are five general sustainability categories, each was allocated a score of 0.2 which, when multiplied by 5, gives a score of one, representing the last enabler. This takes the sum of the political/institutional sustainability category to 7.2 (7 + 0.2) out of 16.

The second most represented general sustainability category is the Social/Cultural category. Of the 16 enablers, 5 fully represented the social/cultural category. The sixth enabler was shared between the social/cultural and economic/financial sustainability categories. Therefore, a score of 0.5 was given to each of the two sustainability categories; this follows, because 0.5 * 2 = 1, representing the sixth enabler. This takes the sum of the social/cultural sustainability category to 5.7 (5 + 0.2 + 0.5) out of 16.

The third and middle sustainability category is the economic/financial dimension. It is fully represented by one enabler. However, considering the previous divisions, the sum of the economic/financial sustainability category is taken to be 1.7 (1 + 0.2 + 0.5) out of 16.

The fourth most represented category is the environmental dimension. One enabler was identified as related to this category. However, considering the first enabler split of 0.2, the sum of the environmental sustainability category is taken to 1.2 (1 + 0.2) out of 16.

Technology is the last category that is not fully represented but was observable in the first split enabler. This implies that the sum of enablers related to technology is 0.2 out of 16.

Key for Table 5.5 and Table 5.7					
Political/Institutional	Social/Cultural	Economic/Financial	Environmental	Technological	Multiple Categories

Table 5.5 Mapping enablers to general sustainability categories

#	Description of Recurring Enablers	Influenced Category of Sustainability
1	understanding and managing (includes monitoring and evaluation) all stakeholder motivations, expectations, and relationships	Political/Institutional
2	formulating, communicating, and agreeing to stakeholder roles and responsibility to ensure accountability	Political/Institutional
3	local community buy-in	Social/Cultural
4	demand-driven ICT4D that reflects the needs of the subject community	Social/Cultural
5	local people inclusion	Political/Institutional
6	local social and economic benefit realisation	Social/Cultural and Economic/Financial
7	ICT4D impact monitoring and evaluation	Political/Institutional
8	ability for ICT4D to adapt to evolving people needs	Social/Cultural
9	need for financial self-sustainability	Economic/Financial
10	local capacity building (skills and infrastructure development)	Social/Cultural
11	clearly defined and communicated ICT4D policy and strategy	Political/Institutional
12	promote local ICT4D ownership	Political/Institutional
13	committed and knowledgeable leadership	Political/Institutional
14	environmentally friendly ICT4D	Environmental
15	increased social network and inclusion of socially excluded groups	Social/Cultural
16	ICT4D must be resilient and take the bricolage approach	All five ICT4D sustainability categories

Figure 5.2 depicts the extent to which each general sustainability category was represented by the enablers in Table 5.5. Since there was a total of 16 enablers, the formula used to derive the percentage representation is as follows:

$$Sustainability\ Category\ Percentage\ (\%) = \frac{Sum\ of\ related\ enablers}{Max\ number\ of\ enablers} * 100$$

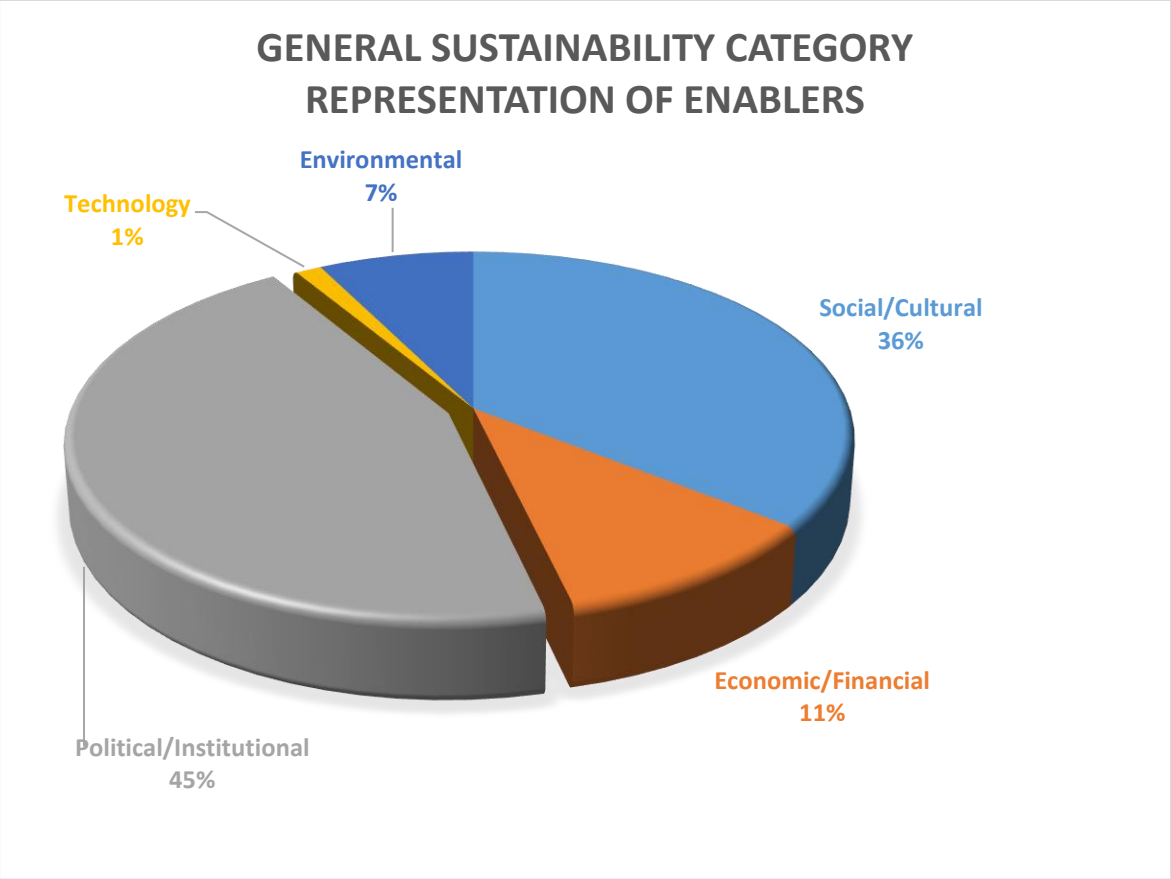


Figure 5.2: *General Sustainability Category Representation of Enablers*

5.4.3 Disablers of Sustainability in ICT4D

A total of two studies addressed only the disablers of sustainability. A further eight articles discussed disablers in conjunction with enablers of sustainability in ICT4D. This means that, from the chosen 40 articles, a total of ten articles focussed on presenting findings and recommendations regarding the challenges and/or barriers of sustainability in ICT4D. Table 5.6 depicts factors identified in more than one article as disablers (barriers/challenges) of sustainability in ICT4D.

Table 5.6 Common Disablers (barriers/challenges) of Sustainability in ICT4D

#	Description of Recurring Disabler	Supporting Number of Articles (max = 10)	Article Percentage Representation
1	lack of intended social, economic, and environmental development and benefit realisation	7	70
2	inadequate, or lack of, infrastructure (software, network, hardware)	6	60
3	inability of ICT4D to be financially sustainable	6	60
4	lack of consensus between stakeholders in relation to their roles and responsibilities, resulting in accountability concerns	5	50
5	inadequate, or lack of, required skills and support	4	40
6	poor design and implementation of policy and strategy	2	20
7	poor ICT4D change management controls	2	20
8	lack of committed and knowledgeable leadership	2	20
9	lack of community involvement and user buy-in	2	20

Figure 5.3 is a representation of the common identified disablers from the 10 articles. As for Section 5.3.2 (enablers), each disabler had to be identified in more than one article in order to be included in Table 5.6. The reason for this is that the researcher focussed the study on a common shared view. Therefore, all disablers that were only identifiable in one article are not represented in the Table 5.6. The same formula used to calculate the percentage representation of enablers was applied again for disablers. The only difference is that the maximum number of articles for enablers was 38, while the maximum for disablers was 10.

$$Disabler\ Percentage\ (\%) = \frac{Visible\ Number\ of\ Articles}{Max\ Number\ of\ Articles} * 100$$

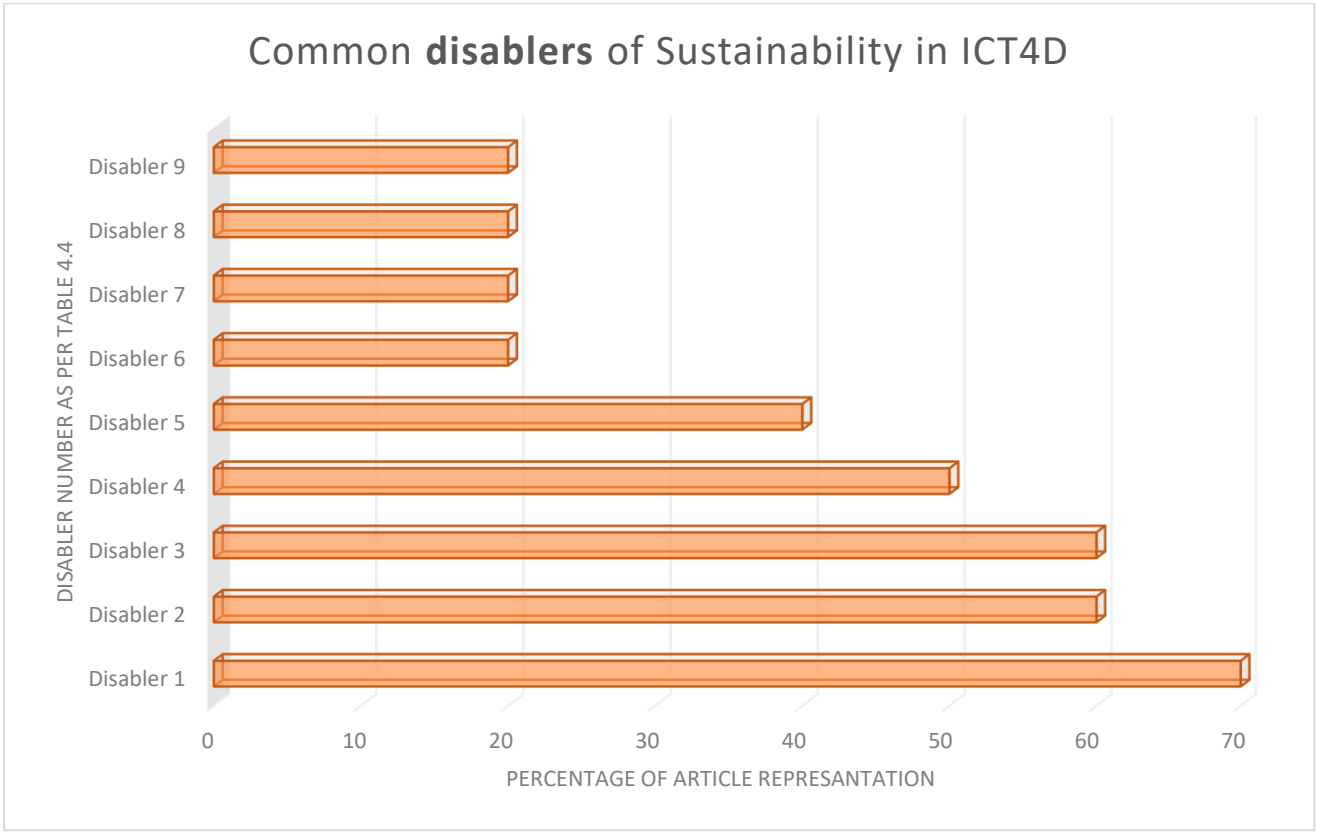


***Figure 5.3**: Common Disablers of Sustainability in ICT4D*

Table 5.7 maps the identified disablers to the general ICT4D sustainability categories.

Table 5.7 Mapping disablers to general sustainability categories

#	Description of Recurring Disabler	Impacted Category of Sustainability
a	lack of intended social, economic, and environmental development and benefit realisation	Social/Cultural, Economic/Financial, and Environmental
b	inadequate, or lack of, infrastructure (software, network, hardware)	Technological
c	inability of ICT4D to be financially sustainable	Economic/Financial
d	lack of consensus between stakeholders in relation to their roles and responsibilities, resulting in accountability concerns	Political/Institutional
e	inadequate or lack of required skills and support	Social/Cultural and Technological
f	poor design and implementation of policy and strategy	Political/Institutional
g	poor ICT4D change management controls	Political/Institutional
h	lack of committed and knowledgeable leadership	Political/Institutional
i	lack of community involvement and user buy-in	Social/Cultural

Table 5.7 shows that the Political/Institutional Sustainability category comprises the largest number of disablers, namely, 4 out of 9.

The second most represented category is the social/cultural dimension. One disabler fully represent this category. However, two other disablers partly represent this category, parallel to other categories. The first disabler can be divided into three categories (1/3 = 0.33), with the social/cultural dimension included. Moreover, the fifth disabler can be divided into two categories (1/2 = 0.5), which also includes the social/cultural category. Therefore, the sum of the social/cultural sustainability category is 1.83 (1 + 0.33 +0.5) out of 9.

The third and middle category is technological. It is fully represented by one disabler. It is also represented by a disabler that is divided between two categories. This means that the sum of its representation is 1.5 (1 + 0.5) out of 9.

The fourth category is economic/financial. It is fully represented by one disabler. It is also represented by a disabler that is divided among three categories. This means that the sum of its representation is 1.33 (1 + 0.33) out of 9.

The last category is the environment, which is only represented by the disabler that is divided among three categories. This implies that the sum of its representation is 0.33 out of 9.

Figure 5.4 depicts the extent to which each general sustainability category is represented by the disablers in Table 5.7. There was a total of 9 disablers, implying that the formula used to derive the percentage of representation is as follows:

$$Sustainability\ Category\ Percentage\ (\%) = \frac{Sum\ of\ related\ disablers}{Max\ number\ of\ disablers} * 100$$

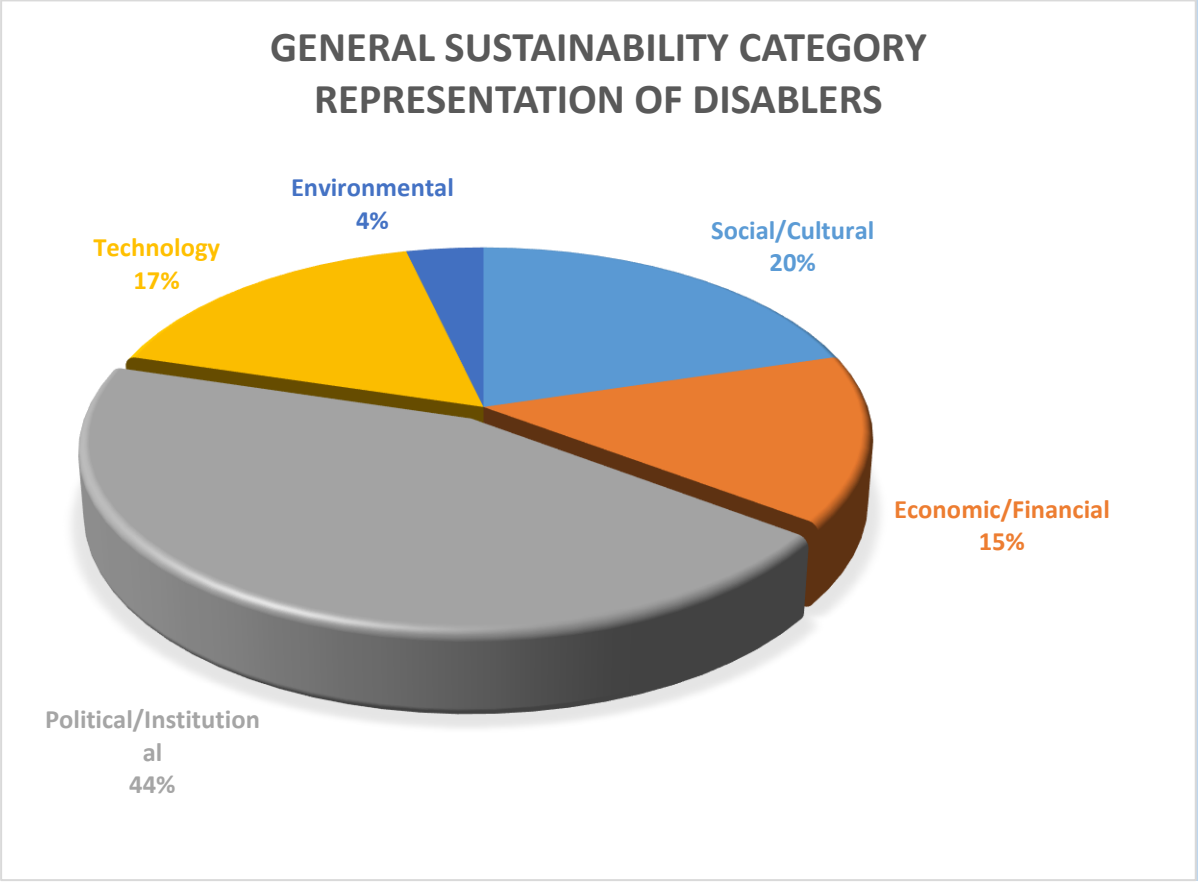


Figure 5.4: *General Sustainability Category Representation of Disablers*

5.4.4 Common Themes between Enablers and Disablers

Developing communities all have different contexts, which is why the influence or impact of the identified enablers and disablers are unique to the intended recipient developing community. The findings and recommendations presented by the selected articles show that the context of the target community can be characterised by either

enablers, disablers, or both, in some cases. Disablers need to be transformed into enablers in order to realise sustainability and sustained benefit realisation. The findings show some recurring themes between enablers and disablers that influence or impact sustainability in ICT4D. These can be summarised into:

i. **Stakeholder Management** is a theme that belongs to the political/institutional sustainability category. It entails understanding stakeholder motivations and expectations for participating in the ICT4D intervention. Roles and responsibilities of stakeholders are also formulated and communicated to stakeholders for agreement in order to encourage accountability within the stakeholder network. Moreover, a component of monitoring is also added to this theme, as it is necessary for ensuring that every stakeholder is held to account for their actions. The monitoring component involves reassessing stakeholder relationships, motivations and expectations as they evolve over time, so that decisions can be made where neccesary to achieve sustainability in ICT4D.

ii. **Local Community Involvement and Benefit Realisation** is about creating ICT-enabled development that reflects the needs of the local people. This can only be achieved when the intended community is engaged in the design and implementation of ICT4D interventions. The involvement of the local community can trigger a number of opportunities including, but not limited to, local user buy-in; further, it helps to build trust between the implementers of ICT4D and its recipients. Moreover, it can lead to benefit realisation that is relevant to local livelihoods. This form of benefit realisation can accelerate local participation and inspire people to support the intentions of the ICT4D intervention as and when they realise benefit. The monitoring component is also key to this theme, because it would ensure that changes to the needs of local people are catered for as context improves.

III. **Committed and Knowledgeable Leadership** is key to achieving sustainability. Many developing countries face the issue of corrupt leadership that does not have the best interests of the people whom they govern at heart. The implementation of ICT-enabled development involves procurement requirements. Procurement should not be used by leaders as a method of self-enrichment, but rather clearly follow procedure and be awarded ethically. Moreover, leaders should be knowledgeable of the needs of their local

communities and make appropriate decisions regarding ICT4D interventions for the benefit of their people.

IV. **Policy and Strategy** entails formulating rules of engagement and setting up principles, together with plans that guide the realisation of sustainability in ICT4D. The policy and strategy must be communicated and agreed upon by all stakeholders.

5.5 A PROPOSED ICT4D SUSTAINABILITY FRAMEWORK

This section of the dissertation presents an ICT4D sustainability framework that has been developed, based on the analysis of findings that were outlined in Chapter 5. The aim of this framework is to create awareness among ICT4D implementers of critical factors that impact sustainability in ICT4D. The framework uses building blocks to represent the factors that impact sustainability, and therefore needs to be carefully considered by the ICT4D stakeholder network when implementing ICT4D interventions.

5.5.1 Framework Building Blocks Explained

The first building block is recognising ICT as a tool or means to be used to achieve development in the poor and marginalised target community. ICT comprises of software, hardware, and network infrastructure that will be used as a mechanism to facilitate development.

The second building block contains the enabler and disabler blocks. These two blocks represent shared perceptions of reviewed articles regarding the factors that could impact the achievement of ICT-enabled development as well as its sustainability. These enablers and disablers are depicted in Tables 5.4 and 5.6, respectively. The 16 identified enablers in Table 5.4 can help achieve sustainability in ICT-enabled development. On the contrary, the nine disablers in Table 5.6 represent elements of obstruction that prevent the realisation of ICT for development and sustainability. Officials and other stakeholders of ICT4D must work on transforming these identified disablers into enablers of ICT for development and sustainability.

The third building block is made up of five blocks, which depict the different spheres that make up the ICT4D intervention and, therefore, forms the context of the subject community. These are the general sustainability categories discussed in Section 1.3.1. These categories have been arranged based on the analysis of findings in Chapter 4, which indicates the most significant (political/institutional) to the least significant category (technological) that impacts sustainability in ICT-enabled development.

The community building block represents the poor or marginalised area for which the ICT for development initiative is intended. Achieving continuous development and realising befits that are relevant to the subject community encourages user participation as well as user buy-in, which are some of the key enablers of sustainability. Development and benefit realisation are therefore the last two building blocks that can be used to determine whether the implementation of ICT has yielded its intended development goals and positive impact on local livelihoods. The frameworks denote that achieving development and benefit realisation is an iterative process due to a number of factors such as changing stakeholder needs, the dynamic nature of the technology or political landscape, and applying lessons learnt from previous implementations for the betterment of future ICT4D implementations.

5.5.2 A Proposed ICT4D Sustainability Framework

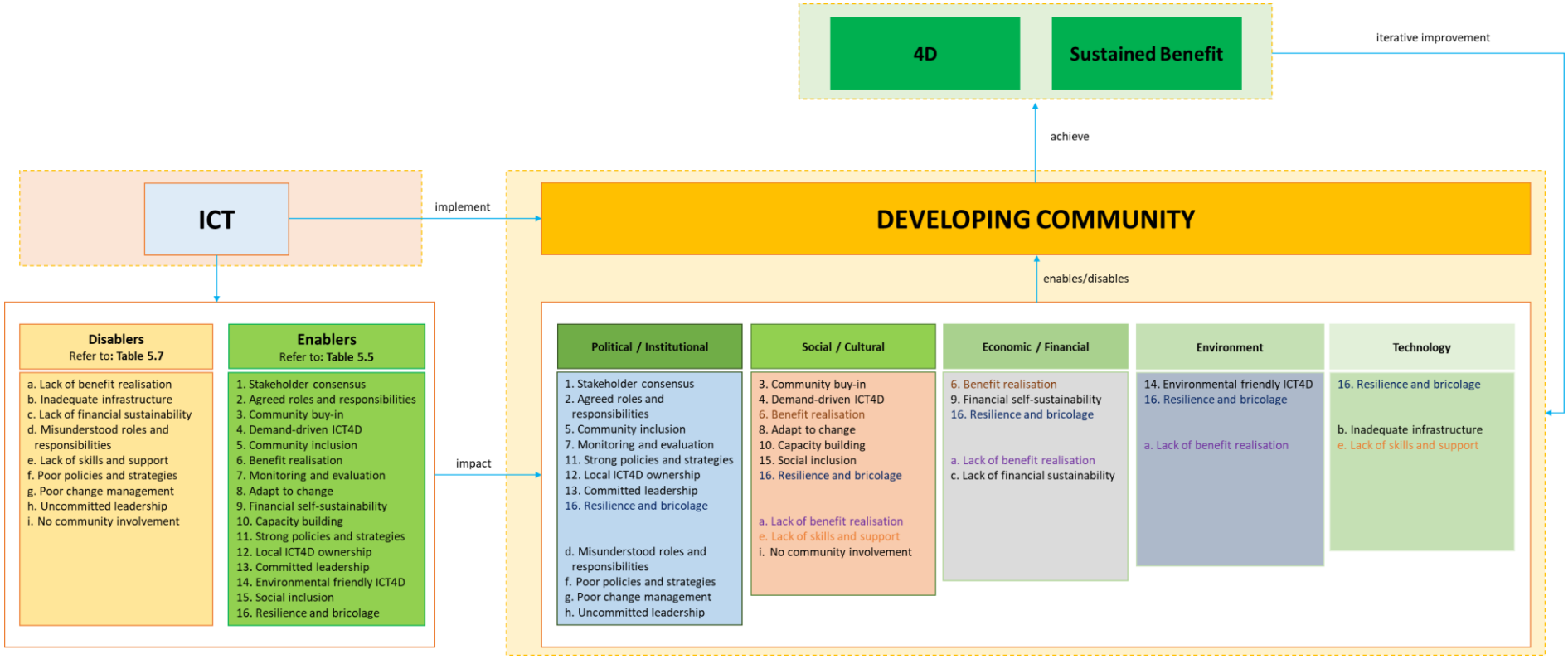


Figure 5.5: *ICT4D Sustainability Framework*

5.5.3 Mapping Enablers and Disablers to ICT4D Project Implementation Phase

Figure 5.6 maps the enablers and disablers presented in the proposed ICT4D sustainability framework above to the separate phases that make up the implementation of an ICT4D intervention. The diagram separates the enablers and disablers into three phases, including pre, during, and post the implementation of an ICT4D initiative. However, some enablers and disablers are classified in-between the circles to indicate that they extend between phases. All the enablers and disablers of sustainability in ICT4D initiatives are numbered and colour coded according to the category numbering applied in Figure 5.5; this is in order to ensure the completeness of each represented general sustainability category. Overall, the mapping is based on the various views outlined by the authors of the 40 chosen articles that were discussed in Chapter 4; it aims to provide an overview of the factors that should be prioritised within each phase of the ICT4D implementation in order to drive sustainability.

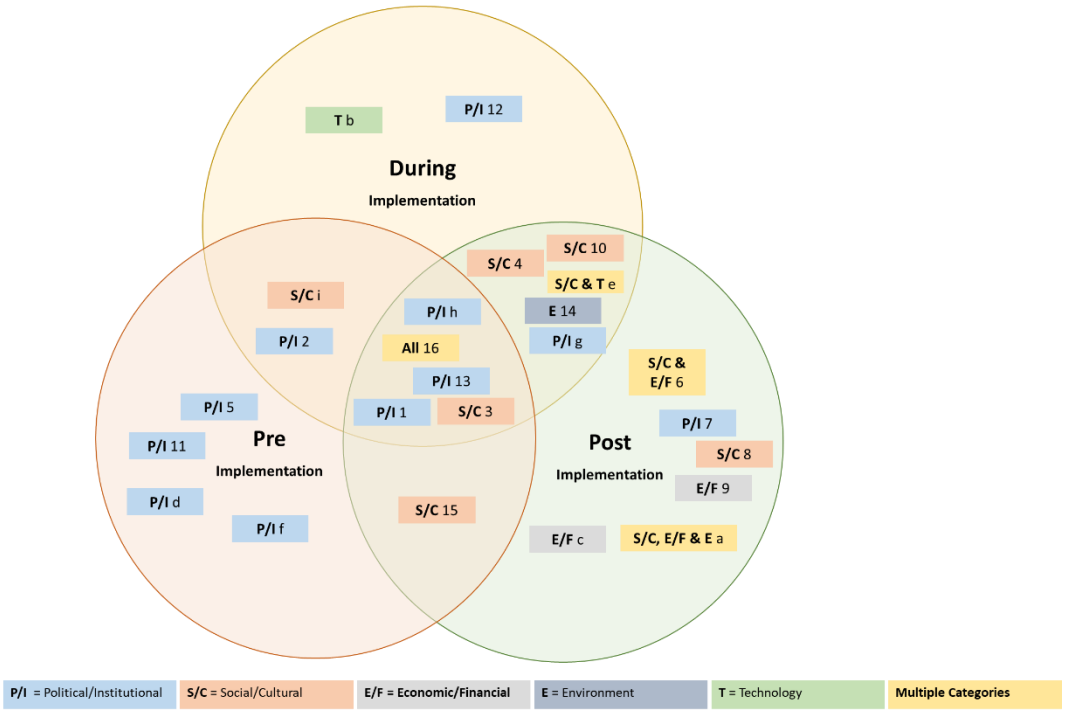


Figure 5.6: *Mapping enablers and disablers to project phase*

Figure 5.5 mapped the enablers and disablers of sustainability in ICT4D to the impacted project phase as understood from the literature review. Table 5.8 below discusses the project phase positioning rationale and implications of each enabling and disabling element to support Figure 5.5. The rationale column provides a

justification for the positioning of each element within the three project phases. The implications column highlights the requirements in terms of resources and activities necessary for carrying out each enabling and disabling element within each phase or between phases. Therefore, Table 5.8 will help provide a view of what ICT4D practitioners and researcher should consider in the various project phases to address these identified enablers and disablers.

Table 5.8 Rationale and implications of enablers and disablers to ICT4D project implementation phase

Phase	S/N	Enabler/Disabler	Rationale	Implications
Pre Implementation	P/I 5	Community inclusion	The conceptualisation and design of ICT4D projects needs to be centred and tailored to reflect the context (e.g. capability and demand) of the subject community. Therefore, community inclusion in the planning and design stages of the ICT4D projects can contribute towards a meaningful outcome of ICT4D initiatives.	• Identify and engage key community stakeholders (e.g. traditional or religious leaders). • Conduct multiple community meetings to understand their expectations and ideas for the ICT4D projects. • Articulate and agree community roles and responsibilities.
	P/I 11	Strong policies and strategies	An ICT4D strategy needs to be developed to set the direction for the ICT4D initiative. It should clearly state the goals that must be achieved by the ICT4D project inline with the community sustainable development efforts. Furthermore, ICT4D policies must be designed to guide decisions and achieve rational	• Clarify ICT4D vision and goals with all stakeholders including subject community. • Formulate, overall ICT4D strategy • Design ICT4D policies to drive decision making that leads to desired outcome. • Document stakeholder communication plan.

			outcomes. Finally, both the ICT4D strategy and policies must be communicated and understood by all stakeholders involved.	• Communicate strategy and policies to all stakeholders. • Define organisational structures.
	P/I d	Misunderstood roles and responsibilities	All stakeholders of the ICT4D initiative must be made aware accept their roles and responsibilities in the pre implementation phase. This is to enable timely delivery, that is within budget, and at the right level of quality.	• Develop and communicate stakeholder responsibility assignment matrix (RACI). • Define and agree stakeholder SLAs and contracts. • Continuously monitor stakeholder performance against SLAs and contracts.
	P/I f	Poor policies and strategies	An ICT4D strategy needs to be developed to set the direction for the ICT4D initiative. It should clearly state the goals that must be achieved by the ICT4D project inline with the community sustainable development efforts. Furthermore, ICT4D policies must be designed to guide decisions and achieve rational	• Clarify ICT4D vision and goals with all stakeholders including subject community. • Formulate, overall ICT4D strategy • Design ICT4D policies to drive decision making that leads to desired outcome. • Document stakeholder communication plan.

			outcomes. Finally, both the ICT4D strategy and policies must be communicated and understood by all stakeholders involved.	• Communicate strategy and policies to all stakeholders. • Define organisational structures.
During Implementation	P/I 12	Local ICT4D ownership	Although this can extend to all project phases, it is however, a critical success factor during the implementation phase of the ICT4D project because of the observable tangible outcome. Active community participation during the implementation of the ICT4D will result in the community acknowledging the ICT4D as an integral part of their daily lives. Furthermore, the project will be more aligned to the community needs and in turn this will increase motivation for local ICT4D ownership and participation.	• Understand and adapt to changing community needs. • Empower local ownership by employing local people and applying local resources and content as much as possible. • Use local champions to promote the ICT4D project. • Encourage local CSI initiatives. • Support local businesses and entrepreneurship.

	T b	Inadequate infrastructure	The availability of infrastructure including power utility and network infrastructure must be ensured to enable the execution of an ICT4D initiative. Infrastructure is a critical component because it is a pre-requisite for using ICT, for example network infrastructure is required to connect to the internet and electricity is required to power hardware such as mobile phones and laptops.	• Define an infrastructure plan. • Define SLA agreements wit infrastructure providers. • Monitor availability of infrastructure and related services. • Escalate an infrastructure issues and ensure that resolution is always within agreed SLAs. • Periodically perform an infrastructure or supplier review to identify whether change is needed with reference to the infrastructure plan.
Post Implementation	P/I 7	Monitoring and evaluation	Monitoring and evaluating the impact of the ICT4D initiative provides insight into how the initiative can be improved going forward to improve performance and achieve better results. The ICT4D strategy should be used as a reference point to determine	• Document lessons learnt that reflect the views of every involved stakeholder. • Produce assessment reports. • Update ICT4D strategy and policies to close identified gaps or opportunities.

			whether the initiative is achieving its mandate.	• Maintain good change management activities as the project becomes operationalised.
	S/C 8	Adapt to change	Once the ICT4D initiative is implemented, it should be able to adapt to change. A variety of factors can trigger this change including changing community needs and technology changes.	• Maintain good change management activities as the project becomes operationalised
	E/F 9	Financial self-sustainability	The ICT4D initiative should not rely too much on donor funding post its implementation to avoid failure when sponsors of the project decide to stop funding.	• Develop a financial model to support self-sustainability of the ICT4D initiative after it has been implemented.
	S/C & E/F 6	Benefit realisation	Benefit realisation is a critical success factor for the ICT4D initiative. The benefit realised should add value to all stakeholders involved including target community, sponsors, and government based	• Define a benefit realisation management plan. • Monitor and manage stakeholder motivations and expectations. • Assess benefits realised against stakeholder agreements and

			on their expectations and motivations.	strategy and policies, in order to identify areas of improvement.
	S/C, E/F & E a	Lack of benefit realisation	Benefit realisation is a critical success factor for the ICT4D initiative. The benefit realised should add value to all stakeholders involved including target community, sponsors, and government based on their expectations and motivations.	• Define a benefit realisation management plan. • Monitor and manage stakeholder motivations and expectations. • Assess benefits realised against stakeholder agreements and strategy and policies, in order to identify areas of improvement.
	E/F c	Lack of financial sustainability	The ICT4D initiative should not rely too much on donor funding post its implementation to avoid failure when sponsors of the project decide to stop funding.	• Develop a financial model to support self-sustainability of the ICT4D initiative after it has been implemented.
Pre-During Implementation	P/I 2	Agreed roles and responsibilities	All stakeholders of the ICT4D initiative must be made aware accept their roles and responsibilities in the pre and during implementation phases. This is to enable timely delivery, that is within	• Develop and communicate stakeholder responsibility assignment matrix (RACI). • Define and agree stakeholder SLAs and contracts.

			budget, and at the right level of quality.	• Continuously monitor stakeholder performance against SLAs and contracts.
	S/C i	No community involvement	Community involvement in these stages enables a tailored project solution that is a key part to the community's growth and efficiency.	• Understand, define, and update evolving community requirements and needs.
During-Post Implementation	S/C 4	Demand driven ICT4D	This enabler emphasises the need to focus the ICT4D project towards the evolving community requirements. The involvement of the community in the design and implementation phase helps to tailor the ICT4D initiative to reflect the needs of the community and therefore ensuring a demand driven approach during and post the implementation of the project to realise the intended benefit.	• Understand, define, and update evolving community requirements and needs. • Employ change management as community needs evolve.

	S/C 10	Capacity building	Skills development and support plan is essential in order to increase the ability for the developing community to effectively participate in the ICT4D initiative during and post implementation.	• Conduct a skills assessment review in order to identify the community skills gap. • Draft and communicate a learning and development plan that takes into account the context of the community. • Conduct trainings to help decrease the skills gap.
	E 14	Environmental friendly ICT4D	The ICT4D initiative must be implemented in a way that does not compromise the developing community's environment. Therefore, the manufacturing and disposal of ICT must be done in a controlled manner that aims to promote reuse, recycle, and reduction.	• Define and implement environmental policies.
	P/I g	Poor change management	Once the ICT4D initiative is implemented, it should be able to adapt to change. A variety of factors	• Maintain good change management activities as the project becomes operationalised

			can trigger this change including changing community needs and technology changes.	
	S/C & T e	Lack of skills and support	Skills development and support plan is essential in order to increase the ability for the developing community to effectively participate in the ICT4D initiative during and post implementation.	• Conduct a skills assessment review in order to identify the community skills gap. • Draft and communicate a learning and development plan that takes into account the context of the community. • Conduct trainings to help decrease the skills gap.
Pre-Post Implementation	S/C 15	Social inclusion	The ICT4D project should be designed and implemented in a manner that encourages participation by all social groups within the community irrespective or gender, ethnicity, or religion.	• Create and publish guidelines for social inclusion.
Pre-During-Post Implementation	P/I 1	Stakeholder consensus	Stakeholder expectation and motivations should be managed effectively in all phases of the	• Develop and communicate stakeholder responsibility assignment matrix (RACI).

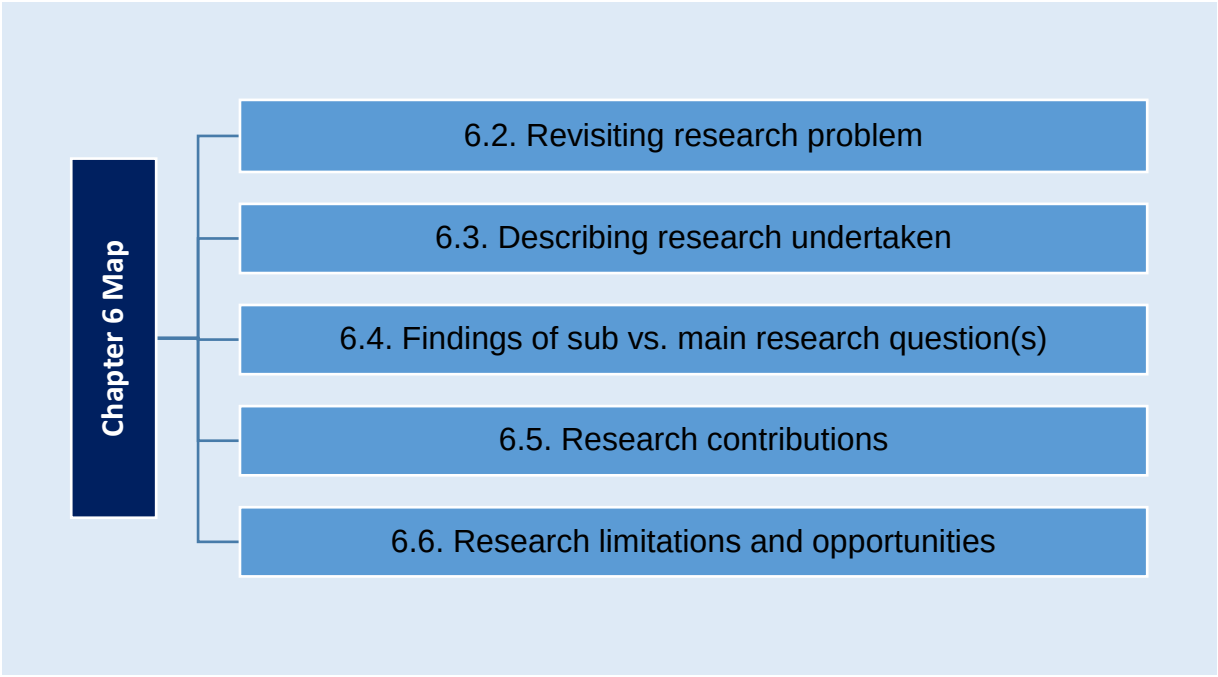
			project for a successful delivery of the project. Moreover, changes to the stakeholder group should be transitioned careful without impact to the implementation of the ICT4D initiative.	• Define and agree stakeholder SLAs and contracts. • Continuously monitor stakeholder performance against SLAs and contracts. • Manage changing stakeholder expectations and motivations.
	P/I 13	Committed leadership	Committed and ethical leadership throughout the project life cycle is required to drive the project in the right direction by making effective decisions that align project execution to the strategy and policies.	• Define decision making framework and guiding principles. • Define leadership team and support structure.
	S/C 3	Community buy-in	Community buy-in is a critical enabler on all phases of the project. The community should be engaged and made to experience the benefit or value of the ICT4D initiative in order to ensure continued community buy-in.	• Understand, define, and update evolving community requirements and needs.

	All 16	Resilience and bricolage	Each phase of the project will face different challenges and opportunities. However, it will be necessary for the project to be resilient as and when challenges come. Furthermore, challenges should not only be viewed as barriers but rather seek alternative methods that help carry the project forward to achieve the intended benefits.	• Define risk management framework. • Define decision making framework and guiding principles.
	P/I h	Uncommitted leadership	Committed and ethical leadership throughout the project life cycle is required to drive the project in the right direction by making effective decisions that align project execution to the strategy and policies.	• Define decision making framework and guiding principles. • Define leadership team and support structure.

5.6 CONCLUSION

This chapter presented the common shared perceptions of sustainability in ICT4D, based on the selected articles. It confirmed that certain factors hinder sustainability, while others enable its realisation. The researcher made use of this information to develop the sustainability in ICT4D framework that is proposed in this chapter. The proposed sustainability framework provides officials and other stakeholders responsible for implementing ICT4D with a view of all essential building blocks that are necessary to achieve sustainability in ICT4D. The manner in which these building blocks affect sustainability is unique to the context of the target developing community. Furthermore, the framework acknowledges sustainability as an iterative development process due to the complex and dynamic nature of certain ICT4D elements. These elements fall within the various spheres or general sustainability categories that make constitute the context of the developing community.

6 CONCLUSION



6.1 RESEARCH OVERVIEW

This research attempted to discover and understand common knowledge published in ICT4D literature about the perceptions of sustainability in ICT-enabled development. A systematic literature review method was employed by the researcher to understand the phenomena from various perspectives, as formulated in different societal contexts. The product of the systematic literature review was to identify shared knowledge that could be used as a foundation for developing an ICT4D sustainability framework. The intention of the proposed framework is to create awareness amongst officials and other ICT4D stakeholders regarding the factors to consider when designing and implementing ICT-enabled development, so that sustainability can be assured. The framework aims to act as a guide that can be used to reduce the wastage of already limited resources in developing areas by prioritising resources to achieve socio-economic development and sustainability.

The first chapter of this research introduced the background information about the study by acknowledging the increased popularity of ICT in developing societies. This was accompanied by some of the key issues that face developing countries when implementing ICT4D — sustainability in particular. This is evident in the problem

statement that was also presented in Chapter 1. Furthermore, Chapter 1 stated the purpose of the research and listed the research questions that were to be addressed by this research. Chapter 2 of the thesis orderly described the research methodology. Each stage of the chosen systematic literature review process was discussed in detail, including the inputs and outputs at each stage of SLR; this was provided in terms of the number of articles produced at each stage. The article selection criteria were also described in Chapter 2. Chapter 3 of the dissertation statistically summarised attributes that describe the data set (40 articles). The fourth chapter discussed the selected 40 articles that contributed to this study. Each article was reviewed and summarised in terms of its findings and recommendations pertaining to sustainability in ICT4D. The fifth chapter comprised an analysis of the findings and recommendations presented in the fourth chapter. So as to identify a shared or common understanding in literature about the key factors that influence or impact sustainability. These factors were then categorised into the generic categories of sustainability, based on the analysis of each enabler and disabler. Chapter 5 concluded by presenting the analysis and findings in terms of an ICT4D sustainability framework. This framework represents the main outcome of this research. Lastly, Chapter 6 provides an overview of the findings of this study and indicates opportunities for future research.

6.2 REVISITING THE RESEARCH PROBLEM

Governments of many developing nations continue to prioritise ICT-enabled development in an attempt to improve local livelihoods from a social and economic standing. However, the sustainability of these initiatives is questioned as they continue to fail, thus worsening the situation in developing countries due to the loss of already limited resources. These limited resources could have been alternatively directed to service delivery initiatives such as water and sanitation, and could have helped to improve people's lives in that sense.

6.3 RESEARCH UNDERTAKEN

A systematic literature review process comprises the research that was undertaken. This process allowed the researcher to analyse 40 chosen studies related to sustainability in ICT4D. The studies were published between the period 2005 and 2018. Secondly these studies included success and failure factors of ICT4D. The

findings show that it is not impossible to achieve sustainability in ICT4D. However, there are certain elements (16 most recurring enablers, as can be seen in Tale 5.4, and 9 recurring disablers, as can be seen in Table 5.6) that impact sustainability and that must be considered by officials in the design and implementation of ICT4D interventions.

The five general categories of sustainability are affected by these factors that enable or disable sustainability in ICT4D initiatives. However, depending on the context of the developing community, each sustainability category is affected differently. Achieving sustainability of all categories in relation to ICT4D requires a great degree of collaboration and effort from all stakeholders. The analysis of findings indicates that political/institutional sustainability is the most critical category that impacts sustainability in ICT-enabled development. This is followed by social/cultural sustainability, economic/financial sustainability, environmental sustainability, and lastly technological sustainability.

The implementation of ICT4D involves a significant number of stakeholders. All of whom have a role to play in achieving sustainability. It is because of these numerous actors that ICT4D is considered to be a highly political endeavour. Transparency is key within the political/institutional category to understand and cater for the existing and changing motivations and expectations of all stakeholders, in order to build trust within the ICT4D network. Stakeholder accountability is also necessary to ensure that every stakeholder is compliant with their roles and responsibilities, and to guide decision making if and when stakeholders (including leadership) are not compliant, as agreed in the organisational structures such as policies and strategies.

Local community involvement and benefit realisation were the most identified factors that form part of the social/cultural sustainability category. The majority of the chosen articles shared consensus that there is a link between these two enabling elements. The perception presented in literature is that the inclusion of local people in the design and implementation of ICT4D would resemble a tailored intervention that results in relevant socio-economic benefit realisation. Moreover, this experienced benefit would attract an even greater number of local participation. This is perceived to be a prerequisite for generating enough revenue to financially self-sustain the ICT4D

initiative. Financial self-sustainability, together with entrepreneurship, are enabling elements of the economic/financial sustainability category. They are both critical to consider when implementing ICT4D because, according to the literature, a significant number of ICT4D interventions that depend on donor funds fail post donor involvement.

Environmental sustainability and technological sustainability are the last two categories affected by the enablers and disablers of sustainability in ICT4D, as presented in Tables 5.5 and 5.7. Environmental sustainability is enabled by protecting the environment from harm caused by ICT implementations. Literature shows that ICT (hardware) makes use of a number of mineral resources that have to be extracted from nature. This is a process that can involve cutting down of indigenous plantations and causing loss of habitat for animals to allow for mining of the required minerals. Moreover, the manufacturing and use of ICT are processes that result in pollution, from the dumping of excess ICT manufacturing material to the disposal of legacy hardware. This is why the business of ICT should be controlled through policy and strategy that is mandated to protect the environment in the long run.

The proposed sustainability framework shows that achieving sustainability in ICT4D entails balancing the requirements of each building block. It also shows the relationship that exists between all the building blocks. The enablers represent an input that is necessary for the output of achieving sustainability in ICT4D initiatives. This is why all known disablers within the context of the target community should be considered in terms of their impact to ICT4D interventions in order to enable informed decision making on how to approach these barriers that hinder sustainability.

6.4 FINDINGS PER RESEARCH QUESTION

6.4.1 Findings on the sub research questions

The following sub research questions were defined:

i. How is sustainability in ICT4D perceived?
ii. What are the factors that influence sustainability in ICT4D according to existing literature?
iii. How does sustainability in ICT4D affect socio-economic development in the context of developing communities?

iv. How does the selected literature definitions and assumptions of sustainability influence the outcome of ICT4D?

The discussion presented in Chapter 4, together with Tables 5.2, 5.4, and 5.6 in Chapter 5, provide a response to the first three sub research questions. Together, these tables show the factors that are perceived to enable or disable sustainability in ICT4D implementations depending on the developing community's context. All 16 of the identified common enablers, together with the 9 common disablers, can be mapped to their applicable general categories of sustainability. The reviewed literature shows that sustainability in ICT4D implementations can help to improve local livelihoods by promoting and ensuring continuous benefit realisation that reflects the needs of the local people. Moreover, as the lives of people improve, their needs change; therefore, ICT4D initiatives must have the ability to adapt to these evolving needs. Table 5.1 in Chapter 5 is a response to the last sub research question, as it compares the authors' definitions of sustainability in ICT4D against the outcome of applicable case studies, as such providing a view of the possible gaps or similarities that exist between the authors' definitions and the outcomes of case studies.

6.4.2 Findings on the main research question

i. What are the factors that influence and/or impact sustainability in ICT4D, according to chosen ICT4D literature?

The response to this main research question is a framework (see Figure 5.5) that illustrates the factors and building blocks that impact or influence sustainability in ICT4D. The ICT4D sustainability framework also shows the relationship that exists between these factors and building blocks. Each building block has certain requirements that need to be fulfilled in order to achieve sustainability in ICT-enabled development. Therefore, ICT4D officials, as well as other affected stakeholders, should not individualise the significance of these building blocks, but rather consider them as a collective requirement for achieving sustainability in ICT4D implementations.

6.5 RESEARCH CONTRIBUTIONS

This dissertation added three main contributions to the existing ICT4D body of knowledge, namely:

i. A discussion of the views on sustainability in ICT-enabled development is outlined in Chapter 4;
ii. A list of enablers and disablers of sustainability in ICT4D initiatives is presented in Chapter 5;
iii. A proposed ICT4D sustainability framework is presented in Chapter 5; and
iv. A mapping of the enablers and disablers to the applicable ICT4D project phase with the rationale and implications of each element discussed in Chapter 5.

6.6 RESEARCH LIMITATIONS AND OPPORTUNITIES FOR FUTURE RESEARCH

The research limitations for this study are as follows:

i. The research only employs a systematic literature review process;
ii. Only 40 articles published between 2005 and 2018 were reviewed and analysed;
iii. Navigation on Google Scholar was limited to the first four web pages;
iv. The articles were sourced from a few selected journals and conference proceedings, as listed and discussed in the methodology section (Chapter 2); and
v. The outcome of the research is a proposed concept framework that has not been practically applied or tested in an ICT4D intervention.

The above limitations resulted from the prescribed period for this work, as defined by the University of Pretoria for the researcher to complete a Masters qualification in Information Technology with a focus on Information Systems. Therefore, there is an opportunity for future research to test the proposed framework in practical case studies. Moreover, future researchers should extend their research method and include engagement with relevant officials responsible for implementing ICT4D initiatives, as well as the target recipients, to test the practicality of the proposed framework.

6.7 CONCLUSION

This paper aimed to identify and understand factors affecting sustainability in ICT4D. The research undertook a systematic literature review process to uncover common or shared phenomena perceptions that have been formulated from different contexts of

ICT4D implementations. This knowledge was represented as a framework that incorporated all significant building blocks perceived in literature as the main drivers of sustainability in ICT4D implementations. The framework is intended to create awareness and act as a guide for decision making amongst officials and/or other stakeholders responsible for the design and implementation of ICT4D initiatives. This framework is anticipated to minimise failure by promoting tailored and structured ICT4D intervention(s) that reflect the needs of the developing community and other stakeholders involved, so that relevant benefit realisation can be achieved to empower participation and user buy-in. As ICT-enabled development takes place, the ability for ICT4D interventions to cater to changing stakeholder needs is critical to maintaining user participation and buy-in, parallel to achieving sustainability in ICT4D initiatives.

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