EXPLORING GREEN ICT IMPLEMENTATION AT A LARGE INFORMATION AND COMMUNICATION TECHNOLOGY COMPANY IN SOUTH AFRICA

Research Paper by

by

Isaac Muranganwa

(19382317)

Submitted in fulfilment of the requirements for the degree

Master of Technology—Information Systems

by full dissertation

in the

Faculty of Economic and Management Sciences

Department of Informatics

UNIVERSITY OF PRETORIA

Study leader: Professor Rennie Naidoo

Date of submission: 03/07/2023

DISSERTATION SUMMARY

EXPLORING GREEN ICT IMPLEMENTATION AT A LARGE INFORMATION AND COMMUNICATION TECHNOLOGY COMPANY IN SOUTH AFRICA

ISAAC MURANGANWA

Supervisor: Professor Rennie Naidoo

Department: Department of Informatics

University: University of Pretoria

Degree: Master of Technology–Information Systems

ABSTRACT

Climate change is a global problem which has pushed world leaders and their respective countries to take definitive measures to address the environmental crises. One of the areas of attention is the information, communication technology (ICT) sector. ICT tools and infrastructure have higher rates of carbon emissions. Therefore, in line with the global call to address climate change, ICT organisations are increasingly becoming involved in the climate change agenda by committing to responsible Information Systems (IS) agenda. The aim of IS, is to ensure that organisational processes enhance the quality of life contribute, while ensuring business sustainability. Green ICT emerged as a result of the IS agenda. Green ICT is a call for ICT users and organisations to take necessary measures to reduce the environmental impact of ICT while enhancing the positive impact by reforming and allowing sustainable business practices. To ensure Green ICT implementation, it is important for organisations to assess Green ICT capabilities and constraints in order to run ICT in accordance with Green ICT best practices. This qualitative, exploratory study sought to investigate the implementation of Green ICT at a large IT professional services company in South Africa, Gauteng. The study employed the Green IT adoption model (GITAM) as a theoretical framework to explore the organisation's current approach to Green ICT implementation. The dimensions of the GITAM model that informed the study are Green IT context, Green IT readiness, Green IT drivers, and the intention to adopt Green IT.

The study population were executive and senior management positions, including C-level managers and operational IT specialists involved in decision-making or day-to-day operations, such as user support and client system implementations in the large IT professional services company. Qualitative data was gathered using semi-structured interviews. The data was then analysed using thematic analysis and the emerging themes were linked to the GITAM model.

The study’s findings revealed that cost reduction, operational efficiency improvement, and corporate image initiatives to fulfil regulatory requirements, customer expectations, and

industry standards drive Green ICT deployment. Green efforts are hampered by the lack of a clear Green ICT strategy and governance concerns. This is due to a lack of environmental responsibility and green metric monitoring. In addition, the findings revealed that the COVID-19 emergency response had a catalytic effect on promoting the implementation of Green ICT. Telecommuting practices were widely adopted and accelerated, assisting the organisation in the implementation of Green ICT, and enhancing resilience to the economic shock caused by the COVID-19 pandemic. This study extends the GITAM model by proposing an interpretive framework for Green ICT implementation. In addition, the findings from the literature review expand understanding on how Green ICT adoption can be a sustainable business model innovation for sustainable recovery after a crisis. In addition to the framework, the study recommends that management should prioritise a comprehensive and principled design approach for Green ICT management. Furthermore, the study interrogates the conflicts of sustainability goals concerning the different environments and stakeholders, showing that addressing the sustainability goals of all relevant stakeholders is complex and challenging. Management should articulate the problem, devise a solution, and set responsibility, learning, and measurement systems for green practises and sustainable projects. Future studies might, among other things, expand on this research and use the G-Readiness Index as a tool to assess and compare the organisation's Green ICT capabilities and limits with other organisations in the industry.

Keywords: Case Study, Green ICT, Green IT adoption model, GITAM, Responsible information systems, G-Readiness framework, sustainable IT, Green ICT corporate policy, Covid-19 emergency response, Business model adaptation, Principled design.

The page was left blank intentionally.

DECLARATION OF PLAGIARISM

I ISAAC MURANGANWA:
Student number: 19382317

Declare the following:

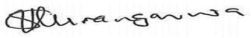
1. I understand what plagiarism entails and am aware of the University's policy in this regard.

2. I declare that this assignment is my own, original work. Where someone else's work was used (whether from a printed source, the Internet, or any other source) due acknowledgement was given and reference was made according to departmental requirements.

3. I did not copy and paste any information directly from an electronic source (e.g., a web page, electronic journal article or CD ROM) into this document.

4. I did not make use of another student's previous work and submitted it as my own.

5. I did not allow and will not allow anyone to copy my work to present it as his/her own work.

	03/07/2023
Signature	Date

DISCLAIMER:

The Department of Informatics emphasises integrity and ethical behaviour with regard to the preparation of all written assignments. The work presented in this report is that of the student alone. Students were encouraged to take ownership of their projects and to develop and execute their research with limited guidance and assistance. The content of the research does not necessarily represent the views of the supervisor or any staff member of the University of Pretoria, Department of Informatics. The supervisor is not responsible for any technical inaccuracies, statements, or errors. The conclusions and recommendations given in the report are also not necessarily that of the supervisor, sponsors or companies involved in the research.

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Professor Rennie Naidoo, for his wisdom, patience, and assistance during the study process. His support has enabled me to become more focused and communicative. I would also want to thank all of the teachers at the University of Pretoria who assisted me in developing the abilities that I used in this study.

I also want to thank all the research participants for accepting to participate in our study and sacrificing their precious time.

Finally, my gratitude goes to my family for their unwavering support throughout the process of completing this research.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND INFORMATION

The subject of environmental sustainability has grown more important in the operations of corporate organisations both internationally and in South Africa. Globally, ICT tools account for 10% of all energy used and 45% of environmental carbon emissions (ICT Footprint EU, 2023; Majeed, 2018). In South Africa, for every 1% increase in ICT activities, there is an increase in carbon dioxide (CO_2) emissions by 0.565% (Atsu, Adams & Adjei, 2021). In light of the ongoing environmental degradation, climate change, and rapid resource depletion worldwide, the Sustainable Development Goals (SDGs), set by United Nations (UN) member states in 2015 highlight the importance of environmental sustainability to achieve development by 2030. Some of the SDGs that address the information communication technology (ICT) sector are SDG 6 (water and sanitation, SDG 7 (affordable and clean energy), SDG 11 (sustainable cities and communities) and SDG 15 life on land (United Nations, 2015). As a result, businesses are changing towards integrating ICT in order to solve and reverse these environmental challenges (Hernandez, 2020a). Numerous parts of corporate operations have drastically changed in direct response to current ecological challenges (Ziemba, 2019a). ICT research has also taken a keen interest in environmental challenges, as well as the creation and use of accountable and sustainable ICT.

ICT has been critical in improving the standard of living and economic development throughout the world, and it is seen as important in developing green economies (Ziemba, 2019a). Klimova (2018) highlights three critical functions for information systems (IS) in the relationship between corporate entities and the surrounding environment. These have an impact on people's environmental views, altering and enabling sustainable practises, and improving environmental performance (Radu, 2018a). Environmentally sustainable ICT integrates environmentally friendly resources, practises, and economic policies that are an advantage to both businesses and the environment.

Green information technology, also referred to as Green ICT, refers to the emerging phenomena of environmental sustainability within the ICT sector. Green ICT is defined by Jabbour et al. (2016:3042) as the ability of an organization to consistently integrate environmental sustainability standards into all aspects of its ICT technical infrastructure, including development, manufacturing, acquisition, utilization, and disposal, as well as within the human and managerial aspects of existing ICT infrastructure. Green ICT implementation efforts, design, and strategy in businesses are an active study topic that is becoming more well-established. Due to the rapid advancement in ICT, the focus has been on making ICT resources more efficient and effective in order to reduce their environmental impact (Hankel, Heimeriks, & Lago, 2018). Green ICT has the power to greatly enhance environmental outcomes by minimizing the harmful effects of ICT usage on the environment. It can also help businesses in various operations and aspects to reduce their adverse impact on the environment. (Klimova, Rondeau, Andersson, Porras, Rybin, & Zaslavsky, 2016).

Research reveals that there are several environmental factors influence the adoption of best practises in the design, development, and use of ICT (Adnan, Nordin, & Ali, 2018). Therefore, there is no single way of approaching Green ICT (Dezdar, 2017). Dezdar (2017) highlighted that there are two ways of approaching green ICT. The first step is identifying ICT areas that directly contribute to greenhouse gas releases and executing strategies to reduce emissions connected with the direct and indirect application of ICT in a business. The second comprises investments in ICT structures that can lower emissions connected with the entire company, including ICT-related carbon emissions (Dezdar, 2017). The focus of this study is Green ICT implementation, focusing on a large ICT company in the South African private sector.

Most businesses are implementing Green information and communications technology (Green ICT) for a variety of benefits and reasons. Some benefits of implementing these practices are a decrease in carbon emissions and environmental harm, enhanced teamwork and cooperation within organizations, increased adaptability of the workforce, saved space, lower energy usage, reduced operational expenses, and improved utilization of systems. (Hernandez & Ona, 2016). Green ICT addresses the environmental effect of ICT across its

whole life cycle, from design and application through end-of-life management of ICT equipment and systems (Buchalcevova, 2016). The concept of Green ICT has been associated with an organisation's success, thus an increasing number of enterprises throughout the world are incorporating one or more forms of sustainable initiatives into their operations (Bohas & Poussing, 2016). As a result, Green ICT is revolutionising organisations' present operating environments and profit margins by decreasing energy expenses (Bekaroo, Bokhoree, & Pattinson, 2016). The implementation of Green ICT policies is regarded as crucial for the achievement of a low-carbon economy and the long-term viability of corporate organisations (Anthony & Majid, 2016).

1.2 PURPOSE OF THE STUDY

Researchers and practitioners on sustainable information systems (Sustainable IS) are always seeking to understand the factors that influence the adoption implementation of Green ICT and findings ways of improving organisations' sustainability capabilities. Much of the work has focused on the deployment of various Green ICT paradigms. In developed countries, there have been studies on Green ICT maturity models to assist organizations in evaluating their current status and finding inspiration for improvement. (Hankel, Heimeriks, & Lago, 2019:7163).

Although the potential benefits of implementing Green ICT such as positive environmental, social, and economic outcomes for organisations are widely researched, most organisations that have shown intention to adopt Green ICT are still struggling to successfully implement it (Hankel et al., 2019). As a result, it is important for organisations to understand their Green ICT sustainability constraints and capacities in order to negotiate the transition to Green ICT implementation. Most of the literature on Green ICT implementation focusses on developed countries (Ara, 2018; Mustafa & Abbas, 2021; Gonel & Akinci, 2018; Nizam & Vilhi, 2018; Radu, 2018a) while the global whole is largely under-represented in literature (Wabwowa, 2019). South Africa is one of the leading economies in Africa, but most companies have been experiencing challenges in challenges of adopting and implementing Green ICT (Bok,

2019). In addition, research reveals that Green ICT has contributed immensely to environmental ruin in South Africa.

This study aimed to explore the factors that influence the successful implementation at a large South African ICT company and propose an interactive framework for Green ICT implementation. Furthermore, the COVID-19, when viewed through the lens of the Green ICT context, prompted several economies to reassess the role of IS in sustainable development in the aftermath of the COVID-19 recovery (Pan & Zhang, 2020; Wells, Abouarghoub, Pettit, & Beresford, 2020). Of note is the fact that there is little research on Green ICT deployment during pandemics (Mustafa & Abbas, 2021). As a result, using the instance of a large South African ICT business, in exploring Green ICT context, which influences Green ICT implementation, the study explored the role of COVID-19 compliance measures on Green ICT implementation.

The research context was one of South Africa's largest technology service providers, with more than 134 locations in and beyond South Africa's borders. To ensure confidentiality, the organisation was given the pseudonym ‘a large South African ICT company’. The consulting, technology, and outsourcing method is a business practice commonly used by many ICT companies in South Africa. The large ICT company attributes its success to its dedication to long-term growth and market expansion. As a result, sustainability is a key component of a significant South African ICT company's business strategy and success, making it an excellent example to explore the variables impacting the implementation of Green ICT. An assessment of the organization's Green ICT implementation gives insights into how the organisation may develop towards best practises in Green ICT and increase its contribution to a green economy.

1.3 PROBLEM STATEMENT

ICT tools are among the biggest sources of CO_2 emissions (Anthony, 2016). ICT-related emissions are linked to manufacture of ICT tools, energy consumption during use, and insufficient recycling of electronic waste (e-waste) (Hernandez, 2020a). These emissions

are hazardous to human health and the environment as a whole. As a result, Green ICT, cannot be disregarded and is an essential component of the panacea for tackling climate change and its related environmental repercussions (Hernandez, 2020a; Ziemba, 2019b; Radu, 2018b; Tutusaus, Schwartz, & Smit, 2018).

Green ICT knowledge and commitment by organisations to embrace and implement Green ICT have grown in recent years (Tutusaus et al., 2018). However, most companies in South Africa have failed to successfully implement Green ICT due to a factors such as lack of implementation guidelines, lack of knowledge about Green ICT and poor government policy on Green ICT (Bok, 2019). South Africa's inadequate adoption of Green ICT demonstrates a limited grasp of the concept of Green ICT. In order to address this, the GITAM model offers theoretical lens that can be used to evaluate the implementation of Green ICT. As a result of the paucity of context-specific research, it may be assumed that there is little knowledge about Green ICT implementation in South Africa which this study sought to address (Hankel et al., 2019). The study builds on the GITAM model, a valuable conceptual foundation for Green IS research, by embracing the use of a single qualitative case study to investigate the experience of participants during a Green IT implementation.

1.4 RESEARCH QUESTIONS

1.4.1 Main research question

The main research question for this study is as follows:

What are the enablers and constraints of Green ICT implementation at a large ICT company in South Africa?

1.4.2 Secondary research questions

The following secondary research questions were formulated to help address the main research question for this study:

i. What are the current approaches used in Green ICT implementation?

ii. What are the drivers of Green ICT implementation at a large ICT company in South Africa?
iii. What are the barriers to Green ICT implementation at a large IT company in South Africa?

1.5 ASSUMPTIONS

In qualitative research, assumptions refer to realistic statements made by the researcher concerning subject being researched (Creswell & Creswell, 2017). Assumptions are important in that they guide the development of a theory or paradigm (Creswell & Creswell, 2017). The following assumptions were made for this study:

- Most South African organisations have not yet fully implemented Green ICT.
- The current Green ICT policies are not clearly defined.
- The barriers to implementation of Green ICT faced by the private sector are lack of incentives, resistance to change, lack of Green ICT awareness and lack of knowledge on Green ICT implementation.

1.6 CHAPTER OVERVIEW

This research comprises seven chapters as follows:

Chapter 1: Introduction

The purpose of this chapter is to lay the foundation for the study. This is done by presenting an overview of Green ICT and the gaps in implementation in South Africa. In the background information, the study motivates the study by reviewing key studies that show the extent to which Green ICT implementation is crucial yet most organisations in South Africa are struggling to implement it. In addition, the chapter explains the study purpose, problem statement, research questions, assumptions, and chapter overview.

Chapter 2: Literature review

Chapter 2 provides a review of relevant literature that explores Green ICT. The chapter is guided by the GITAM model. As such, the key thematic focus of the literature review is Green ICT context, Green ICT readiness, Green ICT drivers, and Green ICT intention and adoption.

Chapter 3: Theoretical framework

In this chapter, several theories were discussed, including their application to Green ICT. These include technology-environment-organisation framework (TOE) framework, theory of reasoned action (TRA), theory of reasoned action (TRA), theory of planned behaviour (TPB), GITAM model and the G-readiness framework.

Chapter 4: Research Methodology

This chapter provides the methodological processes that were followed in this single Green ICT implementation case study. The chapter begins by explaining research philosophy provides justification for choosing the interpretivist philosophy. Secondly, the chapter describes the research approach and the choice of the qualitative approach. Different types of research designs are provided and the justification for utilising the case study design is provided. The chapter also discusses population and sampling, data gathering instruments, data administration, data analysis, trustworthiness difficulties, and ethical considerations.

Chapter 5: Analysis and presentation of findings

This chapter presents the research findings obtained from the primary data collected using methods and techniques identified in the previous chapter. Using the GITAM model, the findings address the current approaches used in the implementation of Green ICT, the Green ICT context, The Green ICT readiness, the Green ICT drivers within a large ICT company in South Africa, and the barriers to the implementation of Green ICT within a large ICT company in South Africa.

Chapter 6: An interpretive framework for Green ICT

This Chapter draws on the findings from the literature review (Chapter 2) and the empirical study (Chapter 5) to propose a framework for Green ICT implementation. Using the findings from the literature review and primary study, the proposed framework was developed from Green ICT theories: technology-environment-organisation framework (TOE) framework, theory of reasoned action (TRA), theory of reasoned action (TRA), theory of planned behaviour (TPB), GITAM model and the G-readiness framework.

Chapter 7: Conclusions and recommendations

This chapter serves as the overall summary of the entire research, highlighting the main conclusions derived from the findings on each of the research questions. It also includes concluding remarks and a summary of the research contributions. By aligning the purpose and goals of the research with the findings, this chapter provides answers to the study's research questions. Furthermore, it offers suggestions for future Green ICT research based on the research findings.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Over the last two decades, there has been a rising emphasis on environmental concerns and sustainability in ICT-related research. The concept of Green ICT has captured the interest of academics and business practitioners alike. This chapter situates Green ICT within the larger area of IS research, providing a brief introduction of the responsible ICT sector. Guided by the GITAM model which explains Green ICT adoption, the chapter provided a brief review of responsible ICT research, an overview of Green ICT, definitions of Green ICT and environmental sustainability. In addition, the chapter explored the role of environmental sustainability, the significance of Green ICT, Green ICT context, Green ICT readiness, Green ICT adoption and Green ICT barriers.

2.2 OVERVIEW OF RESPONSIBLE ICT RESEARCH

With rapid growth in ICT tools, there has been an increase in IS research and the IS research group has been progressively interested in developing an ethical agenda for the subject. Concerns had been raised concerning the field's lack of attention on ethical considerations (Bryman, 2015). Given how IS has grown intimately tied to all elements of society and is now a critical component in various industries, including health, education, manufacturing, and finance, to name a few, ICT research has become a subject of interest for scholars. According to research, there is an insufficient emphasis on critical thinking and reflection in the area (March & Niederman, 2012). It is now more important than ever to evaluate ethical questions since ICT is inherently integrated in society and has a direct and indirect influence on many lives all over the world. As a result of these challenges, the discipline of responsible IS research has reasonably grown over the years, carving out an identity and purpose. While there is limited agreement among researchers on a final perspective and strategy, many believe that the goal should be on harnessing ICT for social benefit. Walsham (2012:88) suggests that scholars and experts should focus on how to use ICTs to help build a better

world, one in which everyone has the capability and prospect to use technology to improve their lives, the lives of their communities, and the lives of the world at large. According to Macnish and van der Ham (2020), information and communication technology (ICT) academics should be involved in understanding and explaining the usage and implementation of ICT for improved societal and organisational practises and results. As a result, ethical IS research is inextricably tied to sustainable development. Addressing social and organisational demands while preserving an equilibrium between economic, environmental, and social factors, all without jeopardising future generations' ability to fulfil their own needs (Murugesan & Gangadharan, 2012). As a result, responsible ICT crosses economic, ecological, and social dimensions. This study focuses on Green ICT as one dimension of a sustainable approach to development. While the study engaged with many studies on Green ICT, the following studies are presented in tables 2.1 and 2.2 indicating Green ICT research at an organisational and individual level respectively.

Table 2.1. Studies in Green IT at an organisational level

CATEGORY	DESCRIPTION	STUDY
Profitability	The Impact of sustainability practices on corporate financial performance	Alshehhi, Nobanee and Khare (2018
Organisational culture	Green ICT implementation strategies	Asabere, Acakpovi and Quaynor (2016).
Organisational culture	Strategic and responsive corporate social responsibility in the adoption of different Green IT strategies	Bohas and Poussing (2016)
Organisational culture	Organisational green IT adoption	Deng and Ji (2015)
Green IT practice	Green practice adoption and implementation	Bokolo, Majod and Romli (2018)
Innovation	re-designing information systems for environmental sustainability	Baskerville, Pries-Heje and Recker (2016).

Leadership	Environmental management quality and financial performance	Boakye (2018)
Leadership	Management of business informatics framework from the Green ICT viewpoint	Buchalcevova (2016)
Green ICT policy	Institutional Pressures on green supply chain management	Chu, Yang, Lee, and Park (2017)
Green ICT costs and benefits	The costs and benefits of environmental sustainability	Ekins and Zenghelis (2021)
E-waste management	E-waste management in developing countries	Heeks, Subramanian and Jones (2015)
E-readiness	E-Readiness for ICT Implementation of the Higher Education Institutions	Irfan, Putra, and Alam (2018b)

Table 2.2: Studies in Green IT at an individual level

Category	Description	Study
Self-motivation	Factors that motivate users on Green IT Readiness	Alsultanny and Alnassar (2017).
Self-motivation	Personal norm and pro-environmental consumer behaviour: an application of norm activation theory	Budi, Afiff and Heruwasto (2021)
Self-motivation	Motivation for Green IT Adoption	Molla and Abareshi (2011)
Individual attitude and perception	Tourists' Perceptions of Green ICT Responsibility	Gao, Huang, and Zhang (2017).
Green ICT knowledge	trends for energy consumption within ICT devices	Chitechi and Odoyo (2020)

Consumer attitude and intention	Role of green technology beliefs on consumer intentions.	Gill, Ansari and Tufail (2021)
Green ICT decision making	The Green Practitioner	Lundfall, Grosso, Lago and Procacciantl (2015).

2.3 OVERVIEW OF GREEN ICT

This following section builds on the previous section which has presented the previous studies on Green ICT that were identified during literature research. This section presents the findings form these studies and further identify research gaps. Firstly, definition of Green ICT is provided, and an operational definition outlined.

2.3.1 Definition of Green ICT

Owing to “the fact that Green ICT is a nascent field of IS research, there is a general lack of consensus on what the term means. Despite the term ‘Green ICT’ being increasingly common in research discussions in IS, business, and environmental sustainability, there is little consensus on the term's meaning. Ambiguities exist in both the meanings of the term ‘Green’ and ‘ICT’. The definition of the term Green ICT ranges from a focus on technological solutions to soft practices by businesses, depending on the perspectives of researchers. Nevertheless, most of the definitions of Green ICT focus on the tangible aspects or hardware components of ICT. Furthermore, definitions of Green ICT vary in meaning. Some definitions are based on reducing pollution and achieving energy efficiency through ‘Greening ICT’. In contrast, others focus on applying ICT to reduce adverse environmental impacts through ‘Greening by ICT’. The following Table 2.4 presents some of the definitions of Green ICT across the literature.

Table 2.3: Definitions of Green ICT

Source	Definition
Murugesan and Gangadharan (2012:24).	Green IT is the study and practice of designing, manufacturing, and using computers, servers, monitors, printers, storage devices, and networking and communications systems efficiently and effectively with minimal impact on the environment.
Chetty, Brush, Meyers and Johns (2009:1033)	Green IT has been created with an allusion to ingenuities which are engrossed in reforming IT into eco-friendly forms.
Molla and Abareshi (2011:68)	Systematic application of ecological-sustainability criteria, such as pollution prevention, product stewardship, and use of clean technologies, for the creation, sourcing, use, and disposal of IT technical infrastructure, as well as within the human and managerial components of IT infrastructure.
Anthony and Majid (2016:3)	It is a methodical application of practices facilitating the minimisation of the ecological effect of IT, exploiting efficacy and efficiency for company-wide carbon emission reductions.
Bekaroo et al. (2016:1581)	Green IT comprises the exercises of designing, engineering and utilising processors, data servers,

	and numerous peripherals proficiently and effectually to ensure minimum ecological mutilation.
Mondragon, Mondragon and Coronado (2017:70)	Green IT or Green ICT in the contracted logic denotes IT/ICTs with little ecological encumbrances; practising ICT as an implementer and facilitator to decrease ecological effects through the frugality of the IT sector.
Hernandez (2020b:50)	Green ICT can be defined as the learning and practice of ecologically sustainable IT/S or computing.
Bokolo et al. (2018:96)	The term Green IT covers all efforts to reduce the environmental damage initiated by IT or to use IT in ethical and positive ways to help accomplish environmental aims and goals.

Table 2.3. definitions show that there is no one explanation for the idea of Green ICT. This viewpoint concurs with Bohas and Poussing (2016), who emphasise that Green ICT encompasses instruments for controlling, directing, and communicating an organization's Green ICT practises. Consolidating the concepts above, this research defines Green ICT as a detailed and rigorous approach for addressing issues with ICT infrastructure, ICT's involvement in the low-carbon economy, and ICT's role in reducing the environmental effect of businesses' ICT operations. For this study, the operational definition of Green ICT that was used is the one provided by Bokolo et al. (2018:96). The definition aligns with the GITAM model used in this study which indicates the various factors that influence Green IT adoption.

2.3.2 Environmental sustainability

Environmental sustainability refers to environmental-friendly attitudes, methodologies, and practices (Sendawula, Bagare, Mbidde, & Turyakira, 2020). Environmental sustainability is also defined as practices that are concerned with the natural environment and how it might remain resilient and productive in order to maintain human existence (Mensah & Casadevall, 2019). According to Jaca, Parieto-Sandoval, Psomas, and Ormazabal (2018), while most organisations try to make money by giving the impression that they are acting responsibly to protect society and the environment, the reality is that these actions have a negative long-term impact on the environment. Environmentally conscious organisations all around the world have prioritised environmental sustainability (Vasanth & Harinarayana, 2015). Having defined environmental sustainability, the next section explores the role of environmental sustainability.

2.3.3 Role of environmental sustainability

According to Asongu et al. (2017), talks regarding environmental sustainability surged after 2015 due to concerns over environmental deterioration. Most rich countries have already begun to make considerable investments in environmental issues. African countries, on the other hand, have been chastised for being tardy to adopt the environmental sustainability agenda since they continue to rely heavily on fossil fuels despite rising environmental concerns (Asongu et al., 2017; Cantore et al., 2017).

The environment, according to Masocha (2018), is vital to the ecosystem since it supplies all of the resources required to sustain all human activities. Because of the expanding conversation about green technology, environmental sustainability has an impact on corporate image. Naidoo and Gasparatos (2018) studied sustainable approaches that firms may utilise to meet the SDGs by 2030. The outcomes of the study revealed that firms must offer updates on their sustainability initiatives in order to protect their reputations (Naidoo & Gasparatos, 2018).

It is critical to implement environmentally friendly practises in order to provide the organisation a good reputation and attract more customers. A wider audience and effective market expansion may ensure that the firm makes even more money (Du & Kang, 2016). Given the importance of the environment in supplying the resources required to support all human activities, we must heed the call for environmental sustainability. To that aim, if sustainability is to be fully implemented, the development of new, economically advantageous technologies is required (Ekins & Zenghelis, 2021).

Implementing Green ICT in the organisation does not only benefit the organisation, but also the environment and society as a whole. Running a sustainable firm provides the following benefits: cost savings, long-term reputation enhancement, competitive advantage, and increased profitability. The ICT sector, which is one of the largest in the world, employs more than 10% of the workforce. As awareness of social and environmental concerns rises, stakeholders and regulatory organisations are putting substantial pressure on the ICT sector to achieve sustainability. In addition, implementing Green ICT has been viewed as one of the ways to enhance corporate image. Alshehhi et al. (2018) conducted a study of the literature on the relationship between sustainability practises and an organization's financial success and discovered a substantial association between an organisation and its financial performance.

Most businesses are concentrating on developing environmental plans that represent the company's commitment to environmental sustainability. A strong organisational strategy is no longer characterised just by its ability to grow profits and its environmental stewardship (Kiron, Unruh, Kushite, Reeves, Rubel, & Felda, 2017). To be effective, the environmental sustainability plan must be integrated into the overall company strategy rather than being considered as a distinct strategy (Cicci & D'Isanto, 2017). Businesses must adapt to change in order to address the consequences of climate change, meet the need for increased production efficiency, and respond to rising public and governmental pressure for ecologically sustainable and moral corporate practises. The ICT industry may be described as a pillar in many affluent countries and a driver for economic growth in developing countries. It has had a significant positive effect on the world economy. However, its activities

and products have a significant detrimental impact on the environment, contributing to greenhouse gas emissions that contribute to global warming (Buchalcevova, 2015). As a result, Green ICT initiatives must be designed, executed, and backed by tight monitoring procedures. With the role of environmental sustainability presented, the next section discusses the significance of Green ICT.

2.3.4 The significance of Green ICT

Most organisations are aware of the benefits of Green ICT implementation. As such, more organisations are incorporating environmental practises into their planning and daily operations, which the GITAM model describes as Green IT readiness (Molla & Cooper, 2008). Some of the Green IT readiness practices include: the introduction of measures to reduce ICT energy use, carbon footprint emissions, non-renewable resource consumption, and residue creation (Foogooa, Bokhoree, & Dookhitram, 2015).

Although Green ICT implementation is difficult for most companies in the global south, it is viewed as a potential solution rather than a cause of environmental concerns (Hankel et al., 2018). As a result, it has become critical for businesses to examine methods for embracing Green ICT. Green ICT implementation dispels the myth that economics and ecology are incompatible while also promoting economic and environmental progress in companies.

There is a global interest for Green ICT research because of its influence on the environmental element of sustainability (Baek & Park, 2015; Kamilaris, Pitsillides, Fidas, & Kondepudi, 2015; Adnan et al., 2018). However, research shows that, while the ICT sector has been critical in resolving difficulties, the entire organisation must be involved in order to generate substantial changes (Hankel et al., 2018). It is also argued that technical and behavioural changes can mitigate the negative impacts of ICT on the environment. The former should focus on improving business and information technology infrastructures to make them more environmentally friendly (Butler, Daly, & Hackney, 2015). As a result, Green ICT manufacturers have improved innovation to ensure goods and services used in

ICT and ICT related organisations support increased energy efficiency and better use of the ICT resources and infrastructure to reduce their environmental impact (Adnan et al., 2018).

Environmentally responsible behaviour may be changed by adopting and implementing organisational rules and activities that are compatible with the organisation's Green ICT strategy (Adnan et al., 2018). Green ICT implementation has a substantial impact on corporate behaviour, culture, financial performance, and other factors (Anthony, 2016; Hernandez & Ona, 2016). The adoption of Green ICT by organisations is universally recognised to facilitate and renovate capabilities essential for basic industry transformation as well as enhanced environmental sustainability (Dezdar, 2017).

The GITAM model, developed by Molla and Cooper (2009), which is the theoretical lens for this study, was used to guide the literature review. Therefore, in reviewing the literature on Green ICT, the following key focus areas were addressed: Green ICT context, Green ICT readiness, Green ICT adoption, Green ICT barriers. The next section explores the Green ICT context.

2.4 GREEN ICT CONTEXT

Context is frequently used to refer to a set of situational elements that comprise the item being processed (Dohn, Hanse & Klausen, 2018). As a result, a context offers circumstances for comprehending a focused item. Context is also described as any detectable arrangement of environmental, mission-related, and agent-related variables that has the potential to predict behaviour (Bazire & Brézillon, 2005:32). The Green ICT context covers the fundamental qualities inherent in the adoption environment and can be evaluated objectively (Molla & Cooper, 2009:660). Molla and Cooper (2008) adds that Green ICT context refers to the characteristics of the existing technology.

Green ICT context highlights the discourse and measures that are out in place to support Green ICT implementation (Green-for-IT). Fernandez, Procaccianti and Lago (2015) define Green ICT context as paradigm shift to the use of ICT to address environmental challenges.

There are different approaches which can be used to understand Green ICT context. The most comprehensive approach to the application of Green ICT was provided by Hernandez (2020b), who provided technological dimensions to Green ICT initiatives These dimensions include data centres, office environment, procurement practices, work practices, and corporate citizenship (Hernandez, 2020b).

2.4.1 Data centres

A data centre is a building where computer systems, including communication and storage systems, are housed. Additionally, it has security, fire suppression, and air conditioning units (Ziemba, 2019a). The part of a facility that is thought to use the most electricity is the data centre. Additionally, the cooling of continuously powered servers, disc drives, and backup systems uses energy (Jayaprakash & Pillai, 2022). It might be a sizable space in a building's basement, or a room stuffed with servers on the other side of the globe that can be accessed online (Heeks et al., 2015). The primary issue with data centres is the constant rise in energy consumption (Heeks et al., 2015).

Research on the use of data centres in the United States of America (USA) shows that the amount of energy used in data centres and other infrastructure increased in tandem with the rapid rise of computer capabilities (Zhu, Leung, Shu, & Ngai, 2015). Based on these findings, it is reasonable to conclude that our demand for energy to run and cool servers has grown in tandem with our need for computer power for everything from corporate management to streaming internet video (Heeks et al., 2015). However, part of the problem stems from the fact that, in a typical data centre, 60% to 70% of the energy consumed is used to power and cool the facility rather than the computers (Borah, Muchahary, Singh, & Borah, 2015: 2). Table 2.4 shows the three kinds of sustainable behaviour. The subsections that follow discuss some common Green ICT implementation practices.

Table 2.4: Categories of Green ICT best practices

Reducing environmental impact of ICT tools	Re-use of ICT tools	Recycling of ICT tools (e-waste recovery)
Server Virtualisation Cooling Efficiency Energy Consumption Telecommuting Paper Reduction	Equipment and Parts	Equipment Disposal

2.4.2 Office environment

To maintain an office environment such as temperature, green audits are an excellent way to save energy. Energy auditors should be consulted to save energy. These energy auditors recommend green innovations such as installing timers to turn off lights automatically, using energy-efficient LED bulbs, and keeping temperatures in a normal range for judicious energy use in the workplace (Gu & Bozzelli, 2015).

2.4.3 Procurement practices

Green ICT procurement practices should ensure that environmental considerations are integrated into purchasing policies, programmes, and actions. These procurement practices are referred to as green purchasing. According to Hendandez (2020b), green purchasing is the purchasing function's involvement in supply chain management activities such as life-cycle analysis (LCA) and environmental design that promotes recycling, reuse, and resource

reduction. There is no standard practice for green procurement (Mcobrein & Ackah, 2019). However, it is advised that the organisation start small and gradually grow. For example, when considering going paperless, an organisation cannot eliminate paper in a single day but must gradually reduce printing paper purchases until they reach their 100% goal of paperless business practises. Green procurement is intended to ensure that purchases provide excellent value for money by considering the entire life cycle and producing social and economic benefits for both the company and the environment (Areguamen, Critchlow, Dereshwisky & Muhammad, 2022).

2.4.4 Work practices

Due to a combination of factors such as government regulations, Corporate Social Responsibility (CSR) and customers' attitudes towards Green ICT practices, most organisations cannot ignore green management (Gu & Bozzelli, 2015). According to Hernandez (2020b), companies are implementing the following workplace green IT measures.

Promote green technology and services: Companies are attempting to promote green technology in all business functions because it is necessary and will bring business benefits such as improved reputation. Green technology concerns innovations that do not harm the environment while maintaining business profitability (Hernandez, 2020b).

Responsible consumption of electricity: Hernandez (2020b) recommends the use of newer electronic devices that use less energy. Some devices can help save up to 70%. In addition, companies should take advantage of the light and rearrange workstations.

Telecommuting: The COVID-19 pandemic pushed most companies to introduce telecommuting. The benefits were not only safety from COVID-19 infection but environmental sustainability as well. Teleconferencing and videoconferencing are used instead of in-person meetings to reduce environmental impact. In addition, organisations are

encouraging the use of fuel-efficient vehicles and vehicles that save energy (Unhelkar, 2016; Tutusaus et al. 2018; Zhu et al., 2015).

Corporate citizenship: Corporate citizenship assumes that an organisation, like an individual citizen, should act with integrity and in a socially responsible manner (Marx & Van Dyk, 2011). According to Hernandez (2020b), corporate citizenship focuses on the identification of the activities and organisational processes that businesses use to meet their social responsibilities. According to several studies, corporate citizenship is an opportunity (Hernandez, 2020b; Thorun, 2018). According to research, environmental improvements, such as waste reduction and increased energy efficiency, benefit the bottom line (Marx & Van Dyk, 2011). To that end, some businesses are conducting small-scale experiments in other areas of corporate citizenship, such as developing products and services for people at the bottom of the social pyramid, but research on the efficacy of these practices is still limited (Hernandez, 2020b). Having discussed the areas of Green ICT, the next section discusses Green ICT best practices.

2.5 GREEN ICT READINESS

Green ICT readiness is a dynamic assessment of an organisation's and the environment's preparedness to absorb Green IT (Molla & Cooper, 2009). Hankel (2019) defines Green ICT readiness as an organisation’s ability to adopt and implement Green ICT as part of its business operations. One of the ways to assess an organisation’s readiness to use Green ICT practices. Some of the common practices which can be used to gauge Green ICT readiness are server virtualisation, cooling efficiency, energy consumption, telecommuting, paper reduction, re-use of equipment and parts and equipment disposal.

2.5.1 Server Virtualisation

Server virtualisation is a popular Green ICT concept that is thought to save energy. Using this approach, organisations can combine servers and other devices using a technique

known as server virtualization. In addition, organisation willing to implement Green ICT can use this technology to run one or more "virtual" servers on a single physical host system (Anthony, 2016). A virtual server functions similarly to a real server in terms of access, addressing, and installation. It does, however, lack specific hardware infrastructure. In a setup where the entire computer is not dedicated to executing just one server software but several, the virtual server shares computer resources with other virtual servers (Anthony, 2016).

Research shows that server virtualisation is one of the most extensively utilised green ICT implementation strategies (Nica, 2015). Utilising the benefits of virtualisation, organisations can more effectively manage and maintain their servers. Server virtualisation benefits organisations by improving disaster recovery and backup capabilities, lowering the cost of maintaining data centres, and creating more productive environments for software development and testing (Adnan et al., 2018). The number of virtual servers that may be put on a single physical server, according to Jayaprakash and Pillai (2022), is determined by the size, processing power, and kind of applications deployed on the virtual servers. According to Borah et al. (2015), four themes are driving virtualization: underutilization of hardware, space constraints in data centres, need for energy efficiency, and a reduction in system management costs. By virtualizing servers, businesses may minimise the quantity of physical equipment in their premises. Increased virtualization would reduce future equipment waste (Nica, 2015). Furthermore, if more physical servers were located in the data centre, the efficacy of the operations would decline (Lautenschutz, Espaa, Hankel, Overbeek, & Lago, 2018). Businesses may run their data centres more efficiently by employing less hardware, preventing the data centre from getting overcrowded with equipment (Suryawanshi & Narkhede, 2015). Virtualization reduces the need for hardware system administration.

It is critical to note, however, that server virtualization does not eliminate the necessity for system management for guest operating systems. As a result, virtualization improves but does not totally replace system administration (Dolci, Lunardi, Salles, & Alves, 2015). System administrators will only have to handle less hardware, but they will still be

responsible for software maintenance. Top green IT businesses rated server virtualization the best green IT technique for energy savings.

2.5.2 Cooling Efficiency

Cooling efficiency refers to the use of less energy during the cooling of ICT tools. A data centre's cooling consumes 60% to 70% of its power (Fernandez et al., 2015). To improve the cooling efficiency of ICT tools, the redesign of the data centre to provide more effective cooling is seen as a Green IT initiative to minimise energy consumption. More cooling is necessary to maintain a steady temperature in the data centre as processing power creates more heat (Lundfall et al., 2015). Servers require the proper humidity and temperature to function properly. Ineffective temperature and humidity management raises energy expenses as a result (Fernandez et al., 2015: 2).

To enhance cooling efficiency, innovators recommend the organisation of data centre equipment into a hot aisle and a cold aisle (Baek & Park, 2015; Foogooa et al., 2015; Lundfall et al., 2015). If the circulation is not interrupted, the hot aisle/cold configuration generates a consistent flow of cool air over the racks. In a hot/cold aisle configuration, the hot aisles are always significantly hotter than the cold aisles. To provide the most efficient cooling fans that pull air in from individual units, the general airflow pattern in the aisles should be deactivated or set up to work with, rather than against, the overall airflow pattern (Foogooa et al., 2015).

2.5.3 Energy Consumption

Most companies are investing in power management technology as a strategy to implement Green ICT. Green ICT compliant ICT tools have automated functions to ensure that when they are not in use, they go into sleep mode (Ziemba, 2019c). For instance, computers shut off when not in use or to go into sleep mode to save energy are examples. Power management systems help organisations lower their electricity use by roughly 40% when compared to relying on workers to manually turn off equipment (Ziemba, 2019b). When computers are asleep, they utilise less energy. The usage of desktop power management

software to minimise energy consumption has been described in research but the research on implementation thereof is limited, particularly in a developing country like South Africa.

Research shows that implementing power management systems gives a rapid return on investment for organisations looking to reduce expenditures and emissions (Ziemba, 2019a).

2.5.4 Telecommuting

Another prominent Green ICT implementation strategy is telecommuting or working from home (Unhelkar, 2016. Telecommuters can also help to reduce greenhouse gas emissions. Employees who are linked to the company's IT systems and carry out their tasks as usual while being physically absent (Zhu et al., 2015) are considered virtual workers. Unhelkar (2016) asserts that work comes to them (electronically), rather than the other way around. Telecommuting, according to Tutusaus et al. (2018), is a key technique to reduce power use and the need for new computers. Despite the fact that there is still work to be done, office space is not required.

Implementig telecommuting allows for lower operating costs and footprints (Unhelkar, 2016). It, for example, provides a paperless office in which employees simply need to sign documents to perform duties. Businesses would also save money on real estate, building upkeep, parking lots, and other infrastructure (Nica, 2015). In addition, telecommuting generate less CO2 as teleworkers will not need to travel or commute to work (Unhelkar, 2016). As a result, fewer automobiles will emit greenhouse gases. Telecommuting, on the other hand, is usually mistaken as a type of vacation and as employees not having to complete their job, which is not the case (Lautenschutz et al., 2018). This view is supprted by a study connducted by by Zhu et al. (2015) which explored the the rate of telecommuting the USA . The results of the study revelaed that telecommuting rose by 70% between 2005 and 2015, whereas the overall workforce only grew by 4.3% over that time (Zhu et al., 2015).

Green ICT policies and computer systems have been designed to address the negative perception of the virtualized workforce (Radu, 2018). However, the corporate culture influences how effectively telecommuting works. According to Tutusaus et al. (2018), virtual teams generally outperform traditional teams when their organisations prioritise their outputs above their inputs. Organisational culture and work standards, for example, should make it clear to telecommuters that they are still regarded employees even when working remotely (Lautenschutz et al., 2018). Furthermore, conditions that restrict workers from working on-site have recently led to the acknowledgement of telecommuting as a requirement for the sustainable and profitable expansion of modern corporate organisations (Radu, 2018b). Much of the economic development and recovery following the COVID-19 epidemic may be ascribed to remote work practises.

2.5.5 Paper reduction

Another Green ICT implementation strategy is to use less paper and become paperless. Green ICT may aid in the development of the necessary technology to assist an organisation in using less paper (Lundfall et al., 2015). Each year, the United States alone consumes nearly 200 million tonnes of wood products (Lundfall et al., 2015). Going paperless is depends on how people behave. While the benefits of becoming paperless are clear, newspaper companies continued to print on paper while having an online presence due to client preferences (Fernandez et al., 2015).

Working with electronic files is thought to be more environmentally friendly than working with printed files since it requires fewer paper. Reduced paper use means fewer trees are cut down for paper manufacture. Furthermore, electronic files facilitate document handling and the production and recovery of document backups. As a result, enterprises can save money by reducing paper expenses and the demand for document storage space. Electronic document management improves productivity by making it easier to locate data files by utilising computerised search capabilities (Jayaprakash & Pillai, 2022). Furthermore, companies generate less waste that must be recycled, burnt, or disposed of in a landfill

(Zhang & Liu, 2015). Businesses may save money on supplies such as toner, printer and copier maintenance, paper, power, and shredding services by printing less (Esfahani, Shahbazi, Nilashi, & Samad, 2018).

Printing on both sides of the paper and avoiding the printing emails are two further ways for reducing paper use (Jabbour et al., 2016). Document scanning also helps to reduce paper consumption; outdated papers may be scanned to free up file cabinet space (Kamilaris et al., 2016). Additionally, fillable PDF forms may be used to electronically complete and submit forms using emails or other software (Borah et al., 2015). Two other paper-saving solutions are online billing and sending faxes electronically using computer software rather than physically transmitting and printing them on paper (Buchalcevova, 2016).

2.5.6 Reuse of equipment and parts

One of the strategies that helps to mitigate e-waste and pollution associated with it is the re-use of ICT equipment and parts. These equipment and parts include hard drives, cables, and other peripherals (Borah et al., 2015). By reusing ICT equipment's components, organisations reduce the cost of buying equipment while reducing the amount of equipment that must be disposed of (Anthony, 2016). Unwanted but still functioning equipment might be donated to organisations who require it. End-of-life equipment should be sent to a recycling firm where it can be deconstructed and some of its components reused (Anthony, 2016). Equipment that is no longer in use but is still in good working order, for example, can be diverted from landfills and donated to non-profit groups.

One of the positive aspects about e-waste management in South Africa is that the current e-waste management policies have reduced the quantity of e-waste that ends up in landfills (Lawhon, 2013). However, there are concerns about rich nations' e-waste being shipped to underdeveloped nations in Asia or Africa under hazardous conditions for deconstruction (Hankel et al., 2018). According to sensible Green ICT practise, all recycling activities must be properly carried out with the least amount of negative influence on the environment and human health (Bekaroo et al., 2016).

2.5.7 Equipment disposal

On a global scale, technology is growing at an alarming rate. The most recent development among developed-world electronic product producers has resulted in a vigorous struggle to make newer electronic items each year. As a result, e-waste has become a global concern, affecting bot developed and developing countries such as South Africa (Samson, 2020). The unrestrained dumping of e-waste will result in people and the environment being exposed to dangers substances such as lead, mercury, polybrominated flame retardants, and cadmium, electronics, particularly computers, are dangerous and can have detrimental health impacts (Dolci et al., 2015). Cadmium, for example, can harm the neurological, urinary, reproductive, and renal systems. Polybrominated flame retardants have also been related to neurotoxicity and endocrine disruption (Molla, Cooper, & Pittayachawan, 2009). Mercury, a common e-waste found in batteries and switches, is considered hazardous and is regularly found in batteries and switches. As a result, waste disposal must adhere to regulations and procedures that encourage environmental conservation.

Green ICT implementation may also contribute to environmental sustainability by handling equipment disposal properly. Many firms have begun to implement programmes to reduce the quantity of equipment they use; nevertheless, adequate care should be taken while disposing of outdated equipment (Verdecchia, Ricchiuti, Hankel, Lago, & Procaccianti, 2017). Electronic equipment cannot be disposed of in the regular trash stream. Electronics should be recycled appropriately rather than just exported (Suryawanshi & Narkhede, 2015). This section explored Green ICT best practices.

The next section discusses Green ICT intention, adoption, and implementation.

2.6 GREEN ICT INTENTION, ADOPTION, AND IMPLEMENTATION

Understood within the context of the GITAM model, there is a difference between Green ICT intention and adoption. Green ICT adoption refers to the actual measures and practices to

ensure environmental sustainability in ICT use while Green ICT intention is limited to a show of environmental concern (Molla & Cooper, 2008). Most of the Green ICT implementation strategies discussed above assist organisations to become more lucrative and ecologically sustainable (Zhang & Liu, 2015). However, a lack of knowledge, budgetary constraints, and staff reluctance to change may stifle such programmes (Tutusaus et al., 2018).

Green ICT implementation has been defined as all procedures that occur between the choice to embrace new ICT solutions and their actual use (Lundfall et al., 2015). Hernandez (2020b) distinguishes between technical and organisational adoption of new ICT systems. Technical implementation, according to Zhu et al. (2015), often takes a linear strategy that overlooks current company culture and behaviour. An organisational approach comprises consulting with the principal users to ensure that the new systems suit their requirements. As a result, implementation is conducted in such a way that the systems blend into current culture and behaviours (Calero & Piattini, 2015). One of the most important aspects of Green ICT implementation is how an organisation manages the transition from an old system to a new system (Zhu et al., 2015). Employee behaviour and expected consequences from deploying new ICT systems and applications must be considered by the company (Bekaroo et al., 2016). This study takes Green ICT implementation as installing and configuring new ICT solutions, as well as teaching an organization's people on how to use the new solutions effectively.

For an organistion to benefit from Green ICT, there is need for successful implementation (Dezdar, 2017). A typical justification for the deployment and acceptance of ICT inside businesses is to provide a way of enhancing growth and increasing an organisation's innovative capabilities (Esfahani et al., 2018). It is widely understood that the effective installation of new technology in an organisational environment requires careful planning, as well as a plan for deliberate organization-wide adoption.

Although Green ICT adoption and implementation are closely related, they have a slight difference in meaning. According to Ludfall et al. (2015), Green ICT implementation refers to the installation and deployment of new ICT solutions, as well as training staff on how to use them (Lundfall et al., 2015). Adoption, on the other hand, comprises a full company

accepting a new ICT solution, integrating it into the organisational process, and improving its efficacy (Nica, 2015). Green ICT implementation is widely recognised as being primarily the responsibility of an organization's ICT staff. At the same time, adoption cannot be accomplished just by an organisation's ICT team since successful organisational transformation involves the engagement of management and leadership (Klimova et al., 2016). One distinctive aspect of Green ICT implementation strategies is that they take longer to break even(Ah-Lian, Eric, Karl, Jari & Georges, 2019). According to Ziemba (2019b), they are influenced more by softer drivers like staff morale and good corporate behaviour than hard dollar investments. These characteristics suggest that when attempting to explain the implementation of Green ICT, it is necessary to include all dimensions of adoption (Ah-Lian et al., 2019).

Although many organisations acknowledge the value of Green ICT, its implementation has been selective (Bohas & Poussing, 2016). Ziemba (2019c) provides two measurements of the breadth and depth of Green ICT adoption. The breadth of Green ICT coverage in several fields is referred to. It assesses if Green ICT is prevalent throughout the ICT activity chain of an organisation. Depth, on the other hand, reflects the amount to which Green ICT has been implemented in a certain domain, such as procurement. The next section provides a review of the drivers of the implementation of Green ICT.

This section was dedicated to a discussion of the implementation and adoption of Green ICT. The next section focuses on the drivers of Green ICT implementation.

2.7 DRIVERS OF GREEN ICT IMPLEMENTATION

The Green IT Adoption Model (GITAM) can help to support the drivers of ICT implementation. The idea will be further explained in Chapter 4. However, certain essential conceptual concepts will be employed to explain the literature. The GITAM model emphasises that Green ICT implementation is influenced by technological, environmental, and organisational context, economic, regulatory, and ethical factors, and how the organisation dealt with technological adoption hurdles (Molla & Cooper, 2008). The key main

factors that influence Green ICT implementation that were identified in the reviewed studies are: Regulatory pressures and incentives, top management support, sustainability culture, compliance and certification, public image, and competitive advantage (Cooper & Molla, 2014; Deng & Ji, 2015; Anthony & Majid, 2016). The factors are discussed in detail in preceding sections.

2.7.1 Regulatory pressures and incentives

Green technology adoption is largely influenced by regulatory constraints and legislative action. Even if businesses are resistant to adopting green technology, government regulations may compel them to green their operations and implement new technologies (Radu, 2018). Government regulations, for example, govern the trash produced by computers and other ICT-related equipment used by enterprises (Mondragon et al., 2017). Non-compliance can lead to fines and legal consequences, which can harm an organization's image and reputation (Hernandez & Ona, 2016). Policies and laws can help green technology adoption by providing incentives and subsidies (Hernandez, 2020a).

According to research, government incentives and awards aid to increase green practise adoption (Hankel et al., 2018). Businesses in Denmark, for example, are required by law to disclose a "green budget" in their annual reports (Hankel et al., 2018). Companies are compelled to comply with regulations despite investing in energy-efficient technology to demonstrate their corporate social responsibility (Boas & Poussing, 2016). Green ICT projects inside enterprises are governed by legislation and regulation in South Africa. They are, however, deemed insufficient and insufficiently implemented to have any substantial impact (Lawhon, 2013).

The government and other regulatory bodies adopt laws, rules, and regulations to serve and protect the public while also addressing environmental and social problems. Because of concerns about the depletion of natural resources and the growth in emissions, a higher number of environmental laws, standards, and regulations have been implemented globally. These environmental policies aim to improve and maintain quality and consistency in areas

such as consumer protection, consumer safety, and environmental protection (Neeveditah, Karishma, & Devi, 2017).

Environmental laws, rules, and policies enacted by government agencies or environmental protection groups are referred to as government regulation. Its fundamental trait is that it is required. Regulatory rules, according to Davis-Sramek, Omar, and Germaine (2019), provide companies with a road map for changing their aims and operational processes to create harmony in the adoption of sustainable practises and the efficient mitigation of inequities. In certain countries, such as Nigeria, the National Environmental Standards and Regulations Enforcement Body (NESREA) is the primary government institution in responsibility of ensuring that the nation's environment is safeguarded. As a law enforcement authority, the NESREA is in charge of enforcing all environmental rules, regulations, policies, frameworks, standards, and laws, as well as any international agreements, protocols, or treaties signed by Nigeria (Chitechi & Odoyo, 2020).

South Africa is committed to minimise greenhouse gas emissions as a signatory to the Kyoto Protocol, which encourages the development of green technology. This concept is further upon when looking at South Africa's reaction to climate change (Cici & D'Isanto, 2017). Following its international duties, the South African Bureau of Standards provides a number of standards that guide the operations of the vehicle sector, ranging from quality management systems to testing processes for specific materials or parts. These will help the organisation improve customer happiness, ensure supply chain consistency, and satisfy regulatory, safety, and reliability criteria. Standards are used everywhere and are critical to the economy because they facilitate business interaction, assist businesses in complying with applicable laws and regulations, accelerate the introduction of new products to the market, and improve compatibility between new and old goods, services, and procedures.

South Africa is now having difficulty ensuring electrical supply while reducing greenhouse gas emissions. Tax breaks will encourage energy users to switch to energy efficiency (EE) and renewable energy (RE), hastening the transition to a greener economy. According to Galpin, Whittington, and Bell (2015), the ideal situation is one in which everyone who contributes to a given environmental problem has an economic incentive to modify their

conduct in favour of a more environmentally friendly one. On December 11th, 2017, the energy efficiency income tax incentive and the renewable energy income tax incentive were added to Section 12B of the Income Tax Act (South Africa) to promote and support businesses seeking to green their offices and buildings. Regulations provide opportunities to boost income by improving internal efficiency (Ekins & Zenghelis, 2021). Reducing capital and operational expenses allows organisations to have a lower environmental effect, which improves corporate sustainability and creates competitive advantage since customers, consumers, and workers choose green enterprises and brands. Environmental regulation may lower pollution emissions and stimulate more green innovation, which can eventually compensate for the expenses of regulation and even generate additional profit (Arpad, 2018).

2.7.2 Top management support

One of the primary motivators for implementing green supply chain management and improving environmental performance is top management commitment (Chu et al., 2017). Through their devotion and leadership, top executives have a tremendous effect on organisational culture and company-wide decision-making processes, which they show by giving resources and incentives to support sustainability projects (Kiesnere & Baumgartner, 2019). According to research, top and mid-level management support is critical for maintaining strong environmental performance (Chu et al., 2017). The attitudes of the engagement of organisational members or partners in accepting such methods, management activities, and systems are significantly influenced by the degrees of support of senior executives (Sugandini, Margahana & Rahatmawati, 2020).

Without top management's active support or willingness for the company's specialised operations, it is impossible for the organization's members who are actively involved in the activities, or their partners, to produce high-level collaboration for the execution of management activities. According to Fernando, Bee, Jabbour, and Thomé (2018), management commitment can influence other internal supply chain stakeholders to embrace

environmentally friendly practises in order to advance sustainability and improve environmental performance.

In an organisation, the responsibility of senior management is to actively support the implementation of certain projects that are critical to the general direction of the organization's internal members and external partners, as well as the creation of a value chain (Sugandini et al., 2020). Therefore, the participation of senior management in Green ICT implementation is a critical success factor for the company's effective Green ICT implementation.

2.7.3 Sustainability culture

Sustainability culture entails that everyone bears responsibilities for helping to reduce environmental degradation and climate change (Kumar & Goyal, 2015). Versey (2021) asserts that any intersectional strategy on climate change must coordinate action among all stakeholders. If we want to stop the trend of ecological degradation, we must establish new cultures oriented on sustainability. The company's culture demonstrates a proclivity to accept environmental change in choices and efforts affected by environmental training. An integrated sustainability and ethical practises culture can highlight efforts to achieve organisational sustainability goals (Li, Mei, Li, & Lee, 2020).

Many everyday acts are social practises that are embedded in broader cultural systems and customs. Unfortunately, this limits the potential for lasting change because psychological approaches to promoting sustainability are overly focused on individual behaviours and frequently fall short of addressing the physical and social circumstances in which individuals are enmeshed (Coleman, Touchie, Robinson, & Peters, 2018). An organisation has a sustainability culture when its employees share certain assumptions and attitudes, such as the need of balancing social justice, economic efficiency, and environmental responsibility. Change projects are more likely to succeed when they are consistent with existing organisational cultures because an organization's culture influences how its employees act (Adam et al., 2018; Niedlich, Kummer, Bauer, Rieckmanna, & Bornmanna, 2020).

Most organisations are increasingly implementing Green ICT for a variety of reasons, including reputation management, employee branding, and cost savings (Adam et al., 2018). Therefore, for these practices to be effectively implemented and understood by all employees, Green ICT strategies should be integrated into a company's core activities, it must be established in its culture (Adam et al., 2018). Organisations in the information and communications technology (ICT) sector are major contributors to sustainability issues, but they can also address current issues with unsustainable production and consumption by using fewer resources, developing goods and services with sustainability in mind, granting more equitable access to goods and services, particularly for those in developing countries, and creating jobs and decent living conditions (Franz, 2012).

2.7.4 Compliance and certification

It should be noted that compliance and certification do not mean the same as environmental regulations. While environmental regulations provide guidelines on Green ICT practices, compliance and certification are monitoring mechanisms meant to ensure that the regulations are followed. Environmental compliance refers to adhering to environmental laws, rules, and standards, as well as other requirements, such as those for operating on a specific site. It indicates faith in and acceptance of the rules, and politicians feel that environmental compliance is critical to the survival of a corporation (Neevedish et al., 2017). A lack of involvement, responsibility, and openness, on the other hand, may stymie the objective of environmental sustainability. Certification for business environmental sustainability is more than just a stamp of approval; it signifies a commitment to putting the ISO's efficiency-driven efforts into action.

An investment in a programme that outlines a few green initiatives that can be checked off a list of completed projects or added to a list of new ones to start up is often required for sustainability certification; failure to comply poses a serious risk to the company. The International Standards Organisation (ISO) 14001 certification programme, which represents state-of-the-art environmental management practice globally and boosts the

company's competitive advantage across all industries, is one way that the South African Bureau of Standards actively supports environmental conservation (Boakye, 2018).

Internal environmental policies, environmental excellence awards, the adoption of environmental certifications such as the International Standards Organisation 14001, and the absence of environmental fines and penalties all demonstrate business-level environmental compliance (Di Pillo, Gastaldi, Levialdi, & Miliacca, 2017). Governments and other regulatory bodies have developed a plethora of laws, regulations, and standards to protect the environment as businesses continue to produce and grow into new markets. In light of Green ICT compliance, organisations may examine their environmental effect in order to leave a cleaner world for future generations while pursuing economic development, reducing pollution, protecting species, and increasing green cover.

Compliance and certification related to Green ICT implementation helps organisations to reduce operational costs, reduce carbon footprint, gain competitive advantage from corporate social responsibility, and realise business profitability (Di Pillo et al., 2017). Because of environmental compliance, the firm may gain operational efficiency in meeting quality requirements and product specifications, which increases the company's competitive edge. Effective and stringent environmental regulations, according to Asongu et al. (2017), push corporations to fully commit to environmental protection.

2.7.5 Public image

The growing awareness of persistent environmental challenges in the 1990s gave the business community with an excellent chance to make firms profitable while also fostering great corporate citizenship (Dezdar, 2017). Green technology adoption can result in considerable cost savings while also improving an organization's public image (Bohas & Poussing, 2016). Sustainability practises boost the public image of businesses. Developing a positive corporate social responsibility image has been linked to increased profitability (Zhu et al., 2015).

Some organisations desire to be recognised for their efforts in social responsibility (Anthony & Majid, 2016). Businesses may present a favourable image of social responsibility and stewardship through green efforts (Verdecchia, Ricchiuti, F., Hankel, A., Lago, P., & Procaccianti, 2017). Public pressure can assist firms in transitioning to more sustainable business practises, such as Green ICT (Zhu et al., 2015). Companies that go above and beyond compliance tend to cultivate a positive public image and impact consumer behaviour and feelings towards brands and goods (Suryawanshi & Narkhede, 2015). However, the importance and concern for a public image are recognised to be less important to organisations and customers in developing nations such as South Africa than in developed ones (Taruna, Singh, & Joshi, 2014).

2.7.6 Competitive advantage

Competitive advantage refers to an organisation's capacity to appropriately adapt to its external environment (Fernandez et al., 2015). According to Fernandez et al. (2015), eco-investments and Green ICT projects may improve organisational performance and provide a competitive edge over competitors, Butler et al. (2015) reflects this opinion. According to them, competitive pressures are the primary motivators for certain firms to adopt green technology in order to obtain a competitive edge. Green ICT serves as both a corporate image strategy for differentiating an organisation from the competition and a business strategy for cost savings and improved operational efficiency (Fernandez et al., 2015).

2.7.7 Cost reduction

Cost-reduction refers to the ability to limit expenses that go towards running a business as a result of deliberate organisational practices (Lundfall et al., 2015). To establish if Green ICT is effective for an organisation, a common practice is to conduct a cost-benefit analysis Organisations are driven to adopt Green ICT due to the cost reductions that follow (Kamilaris et al., 2015).

The implementation of Green ICT improves a company's environmental status while lowering total cost of ownership and increasing total environmental value of ownership (Lundfall et al., 2015). Green technologies enable an organisation to lower operating expenses associated with energy consumption and paper usage while also expanding their operational footprint (Fernandez et al., 2015).

This section presented literature on the drivers of Green ICT implantation, providing international and South African examples. The next section presents the barriers to Green ICT implementation.

2.8 BARRIERS TO GREEN ICT ADOPTION

Green ICT implementation has various potential benefits. However, as indicated in chapter 1, most companies in developing countries face numerous hurdles in the implementation of Gren (Hankel et al., 2018). Green ICT activities help firms when well conducted; yet some organisations do not gain from turning green (Hernandez & Ona, 2016). Those organisations regard green ICT initiatives as expenses rather than possibilities (Esfahani et al., 2018). Organisational personnel must be appropriately informed on the subject of Green ICT to reduce misunderstanding (Radu, 2018). According to Verdecchia et al. (2017), there are four knowledge/awareness gaps among ICT workers.

2.8.1 Awareness gap

There is a strong agreement among researchers that the success of Green ICT implementation is slowed by a lack of understanding among ICT professionals about the significance of Green ICT to environmental sustainability. Furthermore, there is a lack of awareness about organisational and environmental legislation, which provides a barrier to reaping the productivity-boosting benefits of Green ICT (Diaz-Garca, González-moreno, & Sáez-martnez, 2015:14). If a corporation lacks the resources to adopt green practises, simply stating that it is aware of the problem will not result in a change of course (Hankel et

al., 2017). As a result, it is evident that there are linkages between Green ICT barriers, as one barrier may have an impact on another.

2.8.2 Knowledge gap

Most South African employees still lack digital literacy. As a result of the digital gap, the employees may not fully comprehend the concept of Green ICT (Hankel et al., 2017). Extant literature shows that a lack of ICT knowledge leads to ignorance when it comes to the adoption of Green ICT (Gu & Bozzelli, 2015). According to Ociepa-Kubicka and Pachura (2017), one obstacle to adoption is a lack of knowledge of the financial benefits of Green ICT. Similarly, Gao, Na, Song, Tian, Strawa, and Du (2020) argue that Green ICT cannot be adopted if there is a shortage of knowledge regarding Green ICT.

2.8.3 The digital divide

A large majority of the population in developing nations, such as South Africa, lacks ICT knowledge and skills. Another impediment to the use of green technology is a scarcity of diverse capabilities, such as creative technical skills (ASSAf, 2014). According to research, employees with limited environmental management skills are unwilling to embrace green practises because they lack the requisite information (Abdullah, Zailani, Iranmanesh, & Jayaraman, 2016). Adopting Green ICT practises, according to Chow and Chen (2009), is limited by a lack of expertise on how to implement and utilise knowledge management principles. As a result, a shortage of highly trained, qualified people is a barrier to the efficient adoption of Green ICT solutions.

2.8.4 Regulatory uncertainties and limitations

Legislative measures are viewed as time-consuming and complex government processes that cause uncertainty and stymie the progress of green technologies (ASSAf, 2014).

According to Otieno, Wabwoba, and Shikhuyu (2019), present laws and government restrictions influence whether Green ICT solutions such as cloud computing are used. Unanticipated changes in governmental laws, whether big or stringent, may have a negative influence on some green technologies, according to Ociepa-Kubicka and Pachura (2017). As a result, governments must ensure that policies are well-balanced and transparent and avoid having ambiguous legal requirements.

2.8.5 Lack of incentives and funding

Lack of financing is considered as one of the biggest barriers to sustainable innovation, particularly in poor countries (Kilkiş, 2016). Continuous investment, not only initial financing for research and development, is required to ensure the sustainability of green technology (Assaf, 2014). Financial obstacles to organisations vary by industry and country, but they have a substantial impact on smaller, unregistered firms, especially in developing countries (Wabwoba, 2019). As a result, while budget limits vary, there are significant financial shortages everywhere. The absence of venture capital further hinders the adoption of Green ICT. Commercial banks' and private equity firms' incapacity and reluctance to undertake the risks associated with technology development hampered the adoption of Green ICT (Assaf, 2014). As a result, there is little funding set aside to promote the scaling-up and commercialization of green inventions. Many green technologies are capital-intensive, rendering them unfavourable in terms of risk-return profiles and short-term payback timelines (Naidoo & Goldstick, 2015).

2.9 STRATEGIES TO MITIGATE BARRIERS TO GREEN ICT IMPLEMENTATION

Previous studies have identified strategies that can be used to address the Green ICT implementation barriers. These strategies are presented in Table 2.5.

Table 2.5: Barriers to Green ICT and Solutions

Barriers to Green ICT implementation	Solutions
Awareness gap	To address the Green ICT awareness gap, educational resources and ICT specialists must be deployed (Dezdar, 2017). Incorporating sustainability-related modules into the educational curriculum in higher education is one way for reducing uncertainty and promoting awareness of Green ICT among ICT professionals and in the business environment. According to Ah-Lian et al. (2019), a few educational institutions in underdeveloped nations, particularly South Africa, have included sustainability issues and concerns into their ICT curricula.
Knowledge gap	To promote ICT knowledge among employees, professional training institutions and universities can be utilised as essential hubs for the establishment of organisational norms among people at all levels of company (Butler et al., 2015).
Digital divide	Employee training and development programmes focusing on digital literacy and Green ICT skills can be implemented. Lack of ICT sustainability education among professionals is expected to be a key obstacle to adopting and implementing Green ICT (Fernandez et al., 2015; Lundfall et al., 2015; Klimova, 2018).

Regulations	Green ICT government laws should be designed with the participation of stakeholders such as business and environmental NGOs.

As indicated in Table 2.5, efforts are being made to address the barriers to Green ICT implementation. The GITAM model supports the view that there are barriers to technology adoption. However, the benefits of Green ICT implementation outweigh the barriers.

2.10 CONCLUSION

This chapter provides a quick survey of the literature relevant to the research's problems. The GITAM model, which is being used as the theoretical lens in this research for Green ICT adoption, is influenced by the following factors: technological, environmental, and organisational context, economic, regulatory, and ethical drivers, and how the organisation dealt with technology adoption barriers. Green ICT has been recognised as a fledgling idea with several definitions, and its deployment in enterprises has been shown to have considerable beneficial benefits on organisational and environmental sustainability. The literature research also found various aspects of Green ICT projects, which may be broadly classified into five major categories: data centres, office environments, procurement, work practises, and corporate citizenship. The research findings also described effective Green ICT implementation as the installation and setup of a new ICT solution, training employees on how it works to enable its effective use, and mostly the responsibility of businesses' ICT teams. Green ICT implementation was also found to be lacking in a formal and widely acknowledged framework that helps decision-making and practises of Green ICT implementation, indicating a large knowledge gap in the present IS literature.

CHAPTER 3: THEORETICAL FRAMEWORK

3.1 INTRODUCTION

This chapter discusses the various theories applicable to Green ICT and from these, the theories employed in this study are justified. The theoretical framework represents the blueprint upon which this study was based. It was drawn from the findings identified in the literature. Furthermore, the design and conducting of this research were informed by the theoretical framework. This chapter discusses Green ICT theories that include the technology-environment-organisation framework (TOE) framework, the theory of reasoned action (TRA), and theory of planned behaviour (TPB), the theory of reasoned action (TRA), GITAM model, the G-readiness framework by Molla and Cooper (2009). The theoretical review helped to explore previous IS research using Green ICT

adoption theories and to justify the suitability of the GITAM model as the theoretical lens for the study.

3.2 PAST STUDIES THAT UTILISED GREEN ICT ADOPTION MODELS

To identify the focus and influencing factors of the adoption in organisations in the Global South and developed countries. The selected articles were published in scientific journals and conference proceedings. The literature search was conducted in databases that include Google Scholar, Web of Science, EBSCO, and ProQuest. To align the search with the Green ICT model reviewed in this chapter, the keywords used in the search were: Green ICT, Green ICT adoption, (TOE) framework, theory of reasoned action (TRA), theory of planned behaviour (TPB), GITAM model and G-readiness framework. Table 3.1 below shows the studies that have utilised Green ICT adoption theories.

Table 3.1: Previous studies that utilised Green ICT theories

Author and year	Theory used	Focus and influencing factors	Research context
Raisinghani and Idemudia. (2015).	Responsible information systems	Green information systems	Global context
Clark (1995).	Responsible information systems	Attributes of management of information systems professionals	Theoretical review
Nguyen, Le and Vu (2019).	Technology-Organization-Environment (TOE)	An extended technology-organization-environment (TOE) framework.	Digital transformation in Vietnam
Jere and Ngindi (2020)	Technology, organisation, and environment framework	Determinants that influence the intention to adopt ICT by SMEs in developing countries.	Focused on SMEs in Pietermaritzburg in South Africa
Baker (201)2	Technology, organisation, and	Type of innovation driven by the TOE.	Theoretical review

	environment framework		
Borgman, Bahli, Heier and Schewski (2013).	Technology, organisation, and environment framework	Adoption of cloud computing	Review of studies that utilised the TOE framework
Hart, Ojiabo, Emecheta and Liu (2016).	Technology, organisation, and environment framework	SMEs' adoption of enterprise resource planning (ERP) software	SMEs in Port Harcourt, Nigeria
Nguyen, Yang, Nguyen, and Thanh (2019).	Theory of planned behaviour	Developed research framework under the circumstance of the green vegetable consumption	Vietnamese consumers, Vietnam.
Abba and Othman (2021).	Theory of planned behaviour	factors influencing decision makers' intentions to adopt Green information technology (Green-IT) in manufacturing sectors in Nigeria.	Decision-makers in the top three manufacturing industries in Nigeria

Dezdar (2017)	Theory of planned behaviour	Influencing factors for Green information technology adoption	Green ICT adoption among students in the context of a developing country.
Marakanon and Panjakajornsak, 2017	Theory of planned behaviour	Perceived quality, perceived risk and customer trust affecting customer loyalty of environmentally friendly electronics products	Consumers of electronic products in Thailand.
Thongmark (2015).	GITAM model	The understanding of youths about Green ICT	Students enrolled at enrolled in a Management Information Systems course in the Thammasat Business School
Farkhondeh, Reza, Masoud and Zeynab (2022).	GITAM model	Chief information Officers' perceptions about technology adoption	The study focused on the Iranian context.
Ghan (2022)	G-readiness framework	Green Technology Implementation Model for Sustainability	public sector in Malaysia

3.3 RESPONSIBLE INFORMATION SYSTEMS

Stahl (2006)'s notion of responsible information systems was examined as a key theory that helps to explain the adoption of Green ICT in organisations. To have a better grasp of the theory, it is necessary to first define the term "responsibility." The etymology of responsibility provides the earliest and most obvious clue to its substance (Stahl, 2006). Responsibility stems from the response, from the act of replying. Other definitions of responsibility see it as having a liability to answer and having such a duty or obligation appears to suggest.

As a result, responsibility attributions always have a goal. It is necessary to understand the objectives to answer the majority of the particular questions concerning responsibility in information systems (Levy, 2005). Attributions of responsibility result in consequences, which might take the shape of punishments, incentives, blame, or praise. Most instances described in the literature emphasize the negative features, and hence the attribution of punishment is frequently considered the primary reason we are interested in attributing moral responsibility (Monson, 2020). Retribution is possibly the oldest and most often used motivation for punishment. One reason for revenge is that punishment corrects the error in the eyes of society. Punishment is thus directed not at the culprit, but at those who witness the crime.

While the concept of vengeance is not new and has many renowned proponents, it appears to be losing favour in various parts of the world, including Western Europe. The biggest objection levelled towards retribution for the sake of retaliation is that it does not affect changing circumstances. If we penalise someone for something she/he did, it will not affect what she/he did (Levy, 2005). As a result, most authors emphasise the significance of deterrence as the primary motivator for punishment. Deterrence through retaliation has been shown to help stabilise societal morals.

The relationship that comes to mind when thinking about responsibility and information systems is the responsibility as a result of information systems (Stahl, 2006). This refers to any circumstance induced by the usage of information technology for which accountability might or should be assigned. The emphasis here is on ex-post attributions for events that

have already occurred. Computers and information technology, particularly when used for business, may have a wide range of effects on norms and behaviour.

Some cases in the literature indicate the use of IT as a moral dilemma, resulting in the attribution of blame ex-post. Developers and users of technology can all be held accountable for their actions and usage of technology. As a result of this, legal and moral penalties, as well as economic and social rewards, may be applied (Stahl, 2006). The next section presents the theories that inform Green ICT research, from which the theoretical framework for the study was adopted.

3.4 THEORIES OF GREEN ICT IMPLEMENTATION

Extant literature on the implementation of Green ICT reveals that the technology-environment-organisation framework (TOE) framework, theory of reasoned action (TRA), and theory of planned behaviour (TPB) can be used to explain the Green ICT context. Other theories that have been used in Green ICT adoption research are the theory of reasoned action (TRA), GITAM model, and the G-readiness framework by Molla and Cooper (2009). As indicated earlier, the study the GITAM model as a theoretical framework for the study but the other theories were reviewed to show the other IS theoretical choices that were available.

3.4.1 Environment-organisation framework (TOE)

The technology, organisation, and environment (TOE) theoretical framework proposed by Tornatzky, Fleischer and Chakrabarti (1990). The TOE framework is a classical framework used to predict the company's intention to adopt an information system (IS). The TOE framework consists of the following three constructs: the technological context, the organisational context, and the environmental context of the company. The technology context technology as a determinant that influences the adoption of new technology innovations. For the new technology adoption to succeed, the organisation must have a company IT infrastructure, employee's technical skills and user time (Radu, 2016). Research

indicates that organisations that are familiar with technology are more probable to adopt innovations (Mouakket & Aboelmaged, 2021). Technology competency is more than just having the equipment; it is important to have innovative and skilful people and people who could keep the organisation ahead of its competitors (Xu, Fan & Hu, 2022). This view is supported by Hoti (2015) who conducted a theoretical review of the TOE framework and identified the main variables influencing the adoption process. The study found that the adoption of Green ICT in small and medium enterprises (SMEs) is the available technology.

Organisation context is about defining the determinants of an organisation, for instance organisational size; the centralisation, formalisation, and complexity of management structure; and communication channels and decision-making (Baker, 2012; Tornatzky et al., 1990). Top executives champion for changes in an organisation, and they hinder progress or encourage the adoption of technology (Chu et al., 2017; Kiesnere & Baumgartner, 2019; Sugandini et al., 2020). The centrality of top management support in Green ICT adoption is revealed in research conducted by Qi, Yun and Shaobo (2015) found that top management support and the regulatory environment are key drivers of technology adoption in organisations. Similarly, Micheni (2015), found that organisational factors such technological expertise, internet availability, financial resources, compliance with information security concern and service infrastructure readiness determined the adoption of cloud computing (Micheni, 2015).

The environment aspect looks at the elements of the structure of industry, service providers of the technology, and environment regulations (Hoti, 2015). Tornatzky et al. (1990) argue that mature and declining industry is less likely to adopt new technology, whilst organisations that are part of fast-growing industries are more likely to adopt technology rapidly. Fast-growing industries adopt technology to maximise production and minimise expenses. Regulators determine whether an organisation could implement certain technology to meet the criteria or not (Micheni, 2015)

Different studies have used the TOE theoretical framework as a lens to study the adoption of technology (Jere & Ngidi, 2020; Ojiabo & Emecheta 2015). Jere and Ngidi (2020) used the TOE to investigate the determinants that influence the intention to adopt ICT by SMEs

in developing countries using Pietermaritzburg in South Africa. The study found that the technology context is the most influential determinant of technology adoption (Jere & Ngidi, 2020). The TOE can thus be utilised in predicting Green ICT intention. It was not applicable for this study as the aim was to go beyond the intention to explore Gren ICT implementation.

3.4.2 Theory of reasoned action (TRA)

The TRA is intended to anticipate people's volitional behaviours and to aid in the explanation of their psychological underpinnings (Ajzen, 1991). The theory of reasoned action is founded on the idea that an individual's behaviour is determined by his or her behavioural intention to accomplish a task (Dezdar, 2017). Behavioural intention is influenced by one's attitude as well as subjective standards. Attitude refers to an individual's sentiments toward a behaviour, whereas subjective norms refer to the individual's judgment of how other people will react to the individual's task performance (Ajzen, 1991).

The theory holds that an individual's behaviour is determined by his or her behavioural intention (BI) to carry out that behaviour. Behavioural intention is described as the product of "attitude toward the behaviour" and "subjective norm" (Sousa, Correia, Viseu & Larguinho, 2022). On the other hand, attitude refers to a person's overall impression of how favourable or unfavourable that behaviour is. Attitude toward a behaviour is the consequence of one's fundamental belief (B) that engaging in the behaviour will result in specified outcomes, as well as an appraisal of the outcomes (E), or a rating of the attractiveness of the outcome (Effendi, Murad, Rafiki & Lubris; Sousa et al., 2022).

The theory is based on the concept that when an individual has a good appraisal of completing the behaviour, the intention to conduct the behaviour increases (Ajzen, 1991). The effect of the social environment on behaviour is highlighted by subjective norms. It is defined as a person's view that the majority of individuals who are significant to him/her believe he/she should or should not execute the in-question behaviour. Subjective Norm is a function of one's normative belief (NB), which is a "person's opinion that the salient referent believes he should (or should not) undertake the behaviour," and his/her motivation to comply (MC) with that referent (Marakanon & Panjakajornsak, 2017). The subjective norm

construct highlights that people frequently act based on their sense of what others believe they should do, and their intentions to adopt a behaviour may be affected by others near them (Bernova, Indah, Heroza, Rachmadita, Septiani & Cahyani, 2019).

The Theory of Reasoned Action has been effectively employed in predicting behaviour intention in green technology in a wide range of settings. Gill et al. (2021), for example, used the theory to examine the factors that contribute to the effective adoption of green technology in Pakistan's banking industry. According to the study's findings, subjective norms, green technology beliefs, green technology knowledge, and green technology attitude all have a major impact in favourably affecting intentions to use green technology. The theory of reasoned action emphasises the significance of the link between attitude and subjective norms (Gill et al., 2021). A related study conducted by Nguyen et al. (2018) indicated that TRA can be used as a framework for communicating climate risk to influence climate behaviour intentions at an individual level.

Mishra, Akman, and Mishra (2014) investigated behaviour toward the adoption of green information technology by applying TRA among IT professionals, showing that behavioural intention positively influences actual behaviour. Green IT adoption can be influenced by consumers' beliefs as indicated by findings from a study conducted by Gill et al. (2021) which utilised the TRA to analyse the determinants that lead to the successful adoption of green technology in the Pakistani banking sector. The findings revealed that subjective norms, green technology beliefs, green technology knowledge, and green technology attitude play a significant role in positively influencing the intentions towards the usage of green technology (Gill et al., 2021).

The TRA, like the GITAM model, has been used to explore Green IT intention. For example, Halgahagam and Kavirathna (2022) reviewed previous studies on behavioural intentions towards green computing using the TRA. Similarly, Chow and Chen (2009) using TRA. The study found that the attitude toward green computing is the dominant factor explaining the belief or intention of IT users to practice green computing (Chow & Chen, 2009). The reviewed studies indicate that the TRA has been widely used in Green ICT research. However, it was not chosen for this study because its constructs do not cover Green ICT

implementation in its entirety, from context, intention, adoption, drivers, barriers, readiness, and adoption as the GITAM model. There are other weaknesses of the TRA that have been raised by its critics.

Critics of the TRA argue that despite the enormous contributions that the Theory of Reasoned Action has made to predicting, explaining, and influencing human behaviour, its most significant weakness derives from the assumption that behaviour is under volitional control (Chow & Chen, 2009). That is, the idea relates to behaviour that is planned out ahead of time. This theory cannot explain irrational decisions, habitual acts, or any behaviour that is not consciously considered.

3.4.3 Theory of planned behaviour (TPB)

The TPB extends the theory of reasoned action by connecting beliefs and behaviour (Kan & Farbrigar, 2017; Petra & Melanie, 2018). TPB's core concept is that intentions govern actions; yet not all intentions are acted on (Buba & Ibrahim, 2021). As a result, the theory investigates the link between behavioural intentions and acts, as well as how intentions might be utilized to forecast behaviour. Volitional control is a critical component resulting in action: whether the individual has free will to do or refrain from performing the desired action (LaMorte-Wayne, 2019).

TPB is made up of five constructs that indicate a person's genuine control over their behaviour (Setiawan, Afiff & Heruwasto, 2020). Attitudes toward behaviour, perceived behavioural control, subjective norms, intention, and behaviour are examples of these. Attitude towards behaviour is a positive or negative inclination toward certain behaviour, the subjective norm is felt social pressure to perform or not execute the behaviour, and perceived behavioural control is an independent predictor of intention (Nguyen, Yang, Nguyen & Thanh, 2019). The individual's assessment of the relative ease or difficulty in doing the activity is referred to as perceived behavioural control (LaMorte-Wayne, 2019:2) TBP is demonstrated in Figure 3.1.

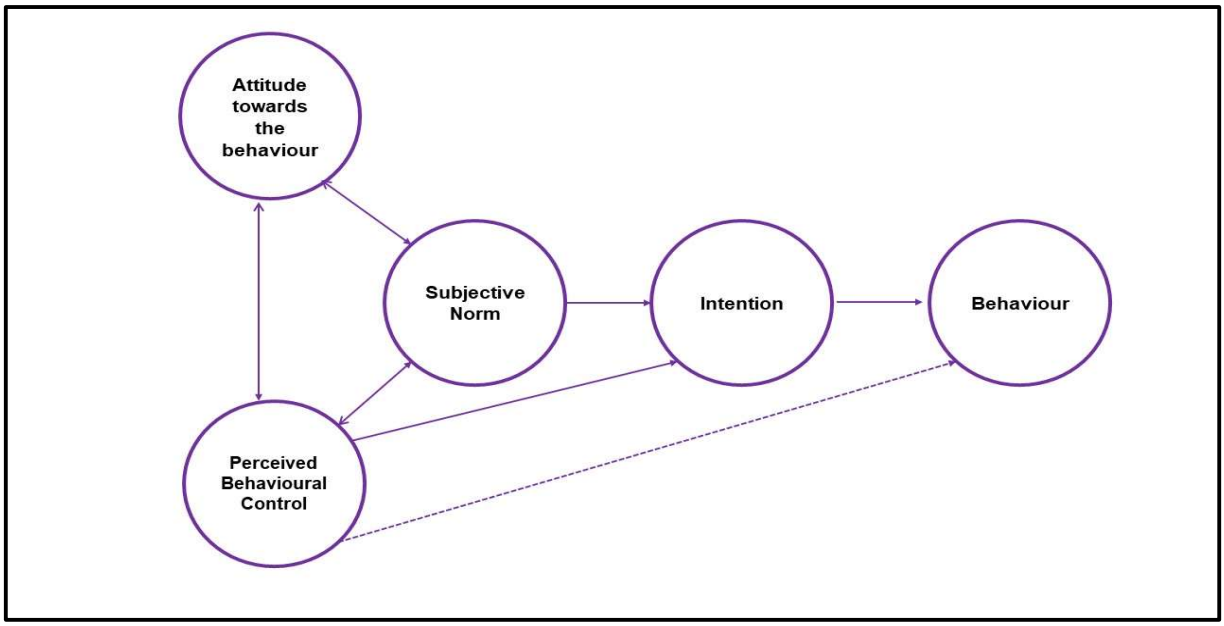


Figure 3.1: Theory of Planned Behaviour

Source: Ajzen (1991:182)

The theory supposes that attitudes toward behaviour, subjective standards, and perceived behavioural control can all influence one's intention to engage in specific behaviours. To a considerable extent, such intents explain the final actual behaviour (Kumar & Goyal, 2016). In essence, the stronger an individual's intention to participate in a specific behaviour, the more likely that behaviour will be exhibited (Özer & Yilmaz, 2019).

Within the Green ICT sector, Dezdar (2017 investigated the variables that impact the intention to use green information technology (IT) (INT) and their subsequent influence on the actual usage of green IT (ACT) among students in the setting of a developing nation using the theory of planned behaviour. The study's findings demonstrated that INT has a favourable relationship with attitude for green IT, subjective norms about green IT, and perceived behavioural control toward green IT. The Theory of Planned Behaviour (TPB) was

employed by Buba and Ibrahim (2021) investigate the elements that might impact decision-makers' intention to embrace Green-IT. The study developed a context-specific model to examine Green-IT adoption in developing nations. Based on previous research that has employed theory of planned behaviour in Green ICT research, changing human behaviours to appreciate and adopt Green ICT, laws and legislation alone are not enough to change human behaviour. Instead, a raft of interactive measures such as awareness campaigns can have a significant impact in influencing intentions to use Green ICT.

3.4.4 Green IT adoption model (GITAM)

This study utilised the Green IT adoption model (GITAM) to understand the Green ICT adoption and practices in a private sector ICT company. The GITAM model, developed by Molla (2008), is an integrated model that explains the adoption of green IT and the drivers of adoption thereof. The GITAM model provides a framework for examining an organization's Green ICT capabilities and constraints in order to acquire insights into how to effectively arrange IT technical and human infrastructure for environmental sustainability (Nizam & Vilhi, 2018). Due to its simplicity and well-structured empirical and theoretical basis, the GITAM model provides an appropriate framework. The model has been experimentally confirmed and validated and is commonly used in practice-based research on Green ICT in enterprises (Bohas & Poussing, 2016).

The model has four constructs: green IT context, green IT readiness, green IT drivers, green IT barriers and green IT intention and adoption (See figure 3.2 below).

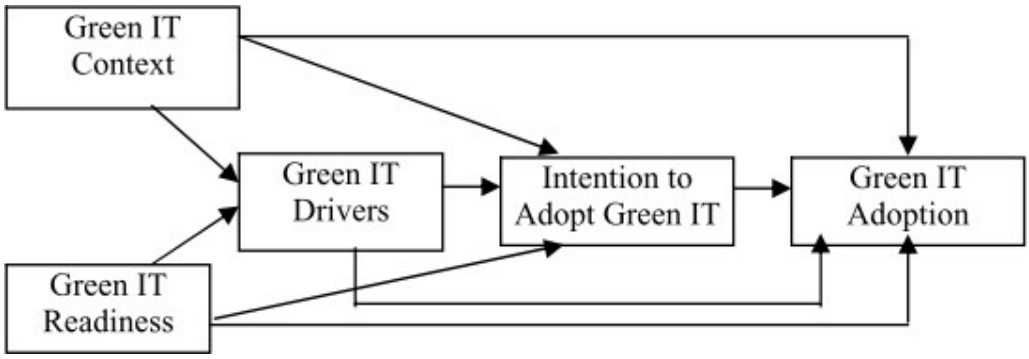


Figure 3.2: The GITAM Model (Molla, 2008, 660).

Green IT context: Green IT context refers to the fundamental adoption qualities that context is concealed, while it can be reasonably objectively measured. This Green IT context includes the following elements: organisational context, technological context, green IT readiness, and environmental context.

Green IT readiness: Molla (2008) defines green ICT readiness as an organization's ability to embed sustainability in beliefs and attitudes in the development, deployment, and disposal of IT technical assets, as well as their IT processes, practises, and policies, and in governance systems, in order to ensure compliance with internal and external sustainability expectations.

Green IT drivers: The GITAM underlines the critical significance of Green IT drivers like as regulatory requirements, public perception, and competitive advantage. Green IT adoption is influenced by regulatory constraints and incentives. Companies are compelled to comply with regulations despite investing in energy-efficient technology to demonstrate their corporate social responsibility (Unhelkar, 2016). Green ICT projects inside enterprises are governed by legislation and regulation in South Africa. They are, however, deemed insufficient and insufficiently implemented to have any substantial impact (Alsultanny & Alnassar, 2017). Green technology adoption is largely influenced by regulatory constraints

and legislative action. Second, the GITAM model indicates that sustainable culture be ingrained in the organisation (Molla, 2008).

The company's culture demonstrates an inclination to accept environmental change in choices and efforts affected by environmental training. An integrated sustainability culture and ethical practises can highlight efforts to achieve organisational sustainability goals (Nizam & Vilhi, 2018). Many everyday acts are social practises that are embedded in broader cultural systems and customs. Environmental compliance refers to adhering to environmental laws, rules, and standards, as well as other requirements, such as those for operating on a specific site. According to Klimova (2018), compliance shows faith in and acceptance of the rules, and politicians feel that environmental compliance is critical to a company's existence.

3.4.5 G-readiness framework

The G-readiness model, developed by Molla and Cooper (2009), aids in understanding an organization's capability to employ ICT sustainability practises in the form of beliefs and attitudes in the development, deployment, and disposal of ICT technical assets, as well as their ICT processes, practises, and policies, for this study. The G-readiness framework is the most widely used framework for implementing Green ICT inside enterprises, and it has been experimentally evaluated and validated in previous studies (Alsultanny & Alnassar, 2017). Furthermore, the G-readiness model is a holistic yet simple approach for studying the elements that influence the adoption of Green ICT inside businesses, which is applicable even for emerging technologies. The G-readiness methodology has been acknowledged as beneficial in ensuring that firms' Green ICT activities are proactive rather than reactive. Green ICT was examined in this study from five perspectives: mindset, policy, practise, governance, and technology. Figure 3.4 depicts the G-readiness model.

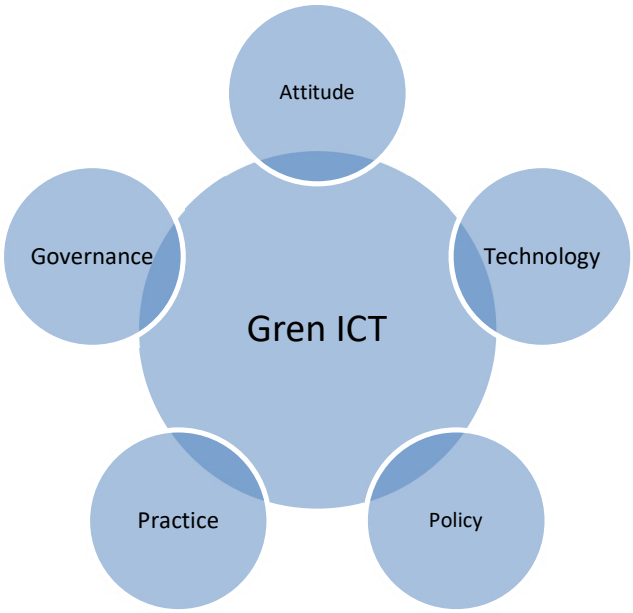


Figure 3.3: G-readiness framework

Source: Molla and Cooper (2009:11).

Green ICT Attitude: Attitude is the first dimension of the Green ICT-readiness framework. Molla et al., 2011; Molla, Cooper, & Pittayachawan, 2009) define attitude as an intangible construct that describes people's thinking rather than their actions. A Green ICT Attitude is concerned with how staff members are knowledgeable and concerned about climate change and the environmental implications of the ICT value chain (Suryawanshi & Narkhede, 2015). The Green ICT Attitude represents people's attitudes about climate change and how they believe ICT will assist society in moving towards environmental sustainability. ICT contributes to greening operations by managing ICT technical infrastructure and improving energy efficiency to reduce greenhouse gas emissions and e-waste.

Green ICT attitude was characterised in this study as attitudes, values, feelings, and norms concerning climate change and sustainability, as well as perspectives on ICT's involvement in these areas (Bridgman & Willmott, 2006). According to Alsultanny and Alnassar (2017),

optimism towards Green ICT is critical and should take precedence over anything else. Positive attitudes are most successful when they are expressed by management experts with the power to determine an organization's goals, develop strategy, and make business choices (Sari, Nugroho, & Nugroho, 2017). Organisations with a favourable attitude towards new initiatives tend to navigate organisational change more effectively than organisations with a negative attitude towards change.

Green ICT Policy: Green ICT policy is the second component of Molla et al. (2009)'s Green ICT-readiness Framework. Green ICT refers to the frameworks developed by a firm to incorporate environmental sustainability principles along each link in its value chain. The organization's Green ICT strategy has an influence on ICT end-of-life management, ICT operations and services, and ICT procurement (Verdecchia et al., 2017). Green ICT policy defines how Green ICT initiatives are managed, how finances and other resources are distributed, and how environmental indicators are measured (Irfan et al., 2018a). A framework for policy formation includes formulating policies, conveying them, enforcing them, assessing their efficacy, and devising mitigating measures (Molla et al., 2009). A Green ICT strategy considers roles and responsibilities, skill sets, commitments, objectives, deliverables, and the procedures required to allow green transformation (Verdecchia et al., 2017).

The policy component of the G-Readiness methodology assesses how much a company's corporate strategy supports sustainability activities. This includes preventing unnecessary packaging, poor recycling, and other behaviours that have a negative impact on the environment. Green ICT policy should encourage ecologically friendly actions throughout the whole ICT value chain, from procurement to disposal. Organisations can implement policies that encourage the sustainable sourcing and purchasing of ICT goods and services. Such rules would give recommendations for monitoring their vendors' environmental footprints and making decisions to purchase equipment and science education from sustainable sources.

Green ICT policy may include rules for computer and equipment power management. Policy considerations for an organisation can also extend requirements for ICT operations to

address sustainability challenges (Irfan et al., 2018). ICT may be utilised to make other elements of a company more environmentally friendly. Smart supply chains and smart building management systems, for example, can benefit from ICT optimisation. Finally, end-of-life policies govern the disposal of ICT equipment and infrastructure, offering guidance for environmentally sound disposal.

Green ICT Practice: According to Marcel (2016), having a policy is not enough to ensure the successful implementation of Green ICT. Policies cannot operate unless they are followed by action. Molla et al. (2009) identify the need for activities and processes to put the Green ICT strategy into effect. The G-Readiness framework's practise dimension includes "the practical application and realisation of eco-sustainability factors in ICT infrastructure sourcing, operations, and disposal" (Marcel, 2016:100). Molla et al. (2009) acknowledge that an organisation may have policies in place but not apply them. The practise dimension demonstrates how firms interpret their Green ICT policies and operationalize environmental sustainability issues across the ICT value chain (Lautenschutz et al., 2018). Green ICT practise, according to Qamata-Mtshali and Bruce (2018), is the actual application and realisation of eco-sustainability principles in ICT infrastructure sourcing, operation, and disposal.

Green ICT implementation needs both human and technological infrastructure along the ICT value chain (Hankel et al., 2019). Evaluating the environmental impact of products and suppliers is one of the eco-sustainability aspects in procuring ICT infrastructure and equipment. Sourcing practises should adhere to criteria that emphasise environmental factors in buying decisions, such as considering the eco-design of items and packaging and purchasing products from sustainable sources (Irfan, Putra, & Ramdhani, 2019). Furthermore, to lessen the environmental effect of operations, firms should consider shortening the refresh intervals for updating equipment (Qamata-Mtshali & Bruce, 2018).

Following sustainable sourcing, ICT infrastructure and equipment should be operated in a sustainable manner. Organisations should think about how they may lessen the environmental effect of their present ICT operations and systems. To begin, it is critical to evaluate how current systems affect the environment; hence, frequent environmental audits

of ICT operations are a crucial Green ICT practise (Molla, Cooper, & Pittayachawan, 2009). Conducting power efficiency audits, mandating power management systems on computers and equipment, retiring low energy-efficient systems, telecommuting, and measures to lower the organization's carbon footprint are some other practises. Green ICT end-of-life management entails managing ICT waste disposal and handling in accordance with eco-sustainability criteria (Khan, Aljaberi, & Muammar, 2019). End-of-life management concepts must, in essence, be addressed in the design of ICT equipment and infrastructure. Considerations for design may include planning for recyclability and reuse, as well as adding eco-sustainable packaging. Considerations for eco-sustainable design aid in ensuring that ICT consumables may be recycled and disposed of in an ecologically responsible manner.

Green ICT Technology: Technology is a crucial instrument in the G-Readiness framework for implementing Green ICT practises. Green ICT Technology activities have been widely classified into four primary functions (Thiengo, Tavares, & Nobre, 2019). To begin, Green ICT technology aids in the reduction of energy usage in information systems infrastructure such as data centres. Second, the technology includes features for improving the energy efficiency of ICT infrastructure and, finally, for lowering greenhouse gas emissions from ICT systems and infrastructure. Finally, Green ICT technology enables projects to offset carbon emissions generated by other corporate processes (Thiengo et al., 2019). As a result, the technology dimension represents how far enterprises have progressed towards more ecologically sustainable ICT infrastructure. Consider clean energy sources, server consolidation and virtualization, retiring applications and technologies in favour of greener technologies, and building solutions to support enterprise-wide sustainability objectives.

The demand for and use of ICT infrastructure is expected to increase further. The digitization of economies and society's greater reliance on technology are ascribed to the growth in demand (Thiengo et al., 2019). As a result, there is an increase in the demand for networking, storage, and computing resources. As a result, the energy consumption and environmental effect of ICT systems are expected to rise further, making it critical for technical breakthroughs to increase ICT system energy efficiency and lower the carbon footprint of their operation (Thiengo et al., 2019).

Green ICT Governance: The G-Readiness framework's last construct addresses the administrative concerns for Green ICT implementation (Irfan et al., 2019b). The elements of governance and policy are intricately intertwined. They describe ICT management's ability to develop environmental standards and guidelines to govern the procurement, operation, and disposal of ICT infrastructure and systems (Irfan et al., 2018b). According to Campbell (2017), efficient governance structures are the most important determinants of an organization's ability to produce value from its ICT systems and infrastructure. Lautenschutz et al. (2018) define ICT governance as the method via which organisations assign decision-making rights and duties and demand responsibility from decision-makers and users. Green ICT governance is the system of decision rights and responsibility that supports environmentally desirable conduct in ICT operations. It establishes defined roles, responsibilities, accountability, and control for long-term ICT efforts (Qamata-Mtshali & Bruce, 2018).

Governance also includes managing change and knowledge, strategic planning, and adhering to business and government policies (Irfan & Putra, 2020). Because these factors fluctuate between enterprises and situations, organisations must tailor their Green ICT governance strategy to their specific scenario (Campbell, 2017). Internal and external variables like as socio-cultural environments and regulatory markets have various effects on governance structures inside businesses, as do human personnel responses to these circumstances (Hankel et al., 2019). The reaction of the organization's workforce is particularly significant since how workers perceive the relevance or ambiguity of Green ICT determines the level of Green ICT adoption in a specific organisation (Thiengo et al., 2019).

Although there is no one-size-fits-all solution, solid governance structures are an excellent predictor of Green ICT readiness (Sari et al., 2017). Through budget and resource allocations, good governance frameworks guarantee that management prioritises sustainability projects. Green ICT governance also guarantees that there are systems in place to track and optimise the environmental effect of ICT activities (Irfan et al., 2018b).

3.5 CONCLUSION

The GITAM model was proposed in this chapter as a lens for understanding Green ICT practises. Several prepotential theories in the domain of solution-oriented research were reviewed, including the technology-environment-organization framework (TOE), theory of reasoned action (TRA), theory of planned behaviour (TPB), theory of reasoned action (TRA), and the G-readiness. The GITAM model was used for this study because it provides a comprehensive yet simple framework for investigating the elements that influence Green ICT deployment. The following chapter discusses the research methodology used for this study, including the methodological choices, methods, and procedures used to arrive at the study's research outcomes, namely the assessment of the approach to Green ICT implementation at a large South African ICT company, as well as the drivers and barriers to implementation in the case organisation.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter gives an in-depth examination of the research methodology and procedures used in this study. The purpose of this research is to better understand the challenges to radical Green ICT change in major organisations by researching the drivers and barriers to effective green IS deployment. The chapter outlines the study's methodology and decisions. Furthermore, the chapter explains the research philosophy and provides a thorough description of the study's research strategy and design. The chapter justifies the decisions taken for selecting the population, measurement instrument, and data collection and analysis methodologies.

4.2 CHAPTER OUTLINE

The study used an interpretative case study technique. Figure 4.1 depicts an overview of the study design process as defined by Walsham (2006) recommendations for constructing interpretative case studies.

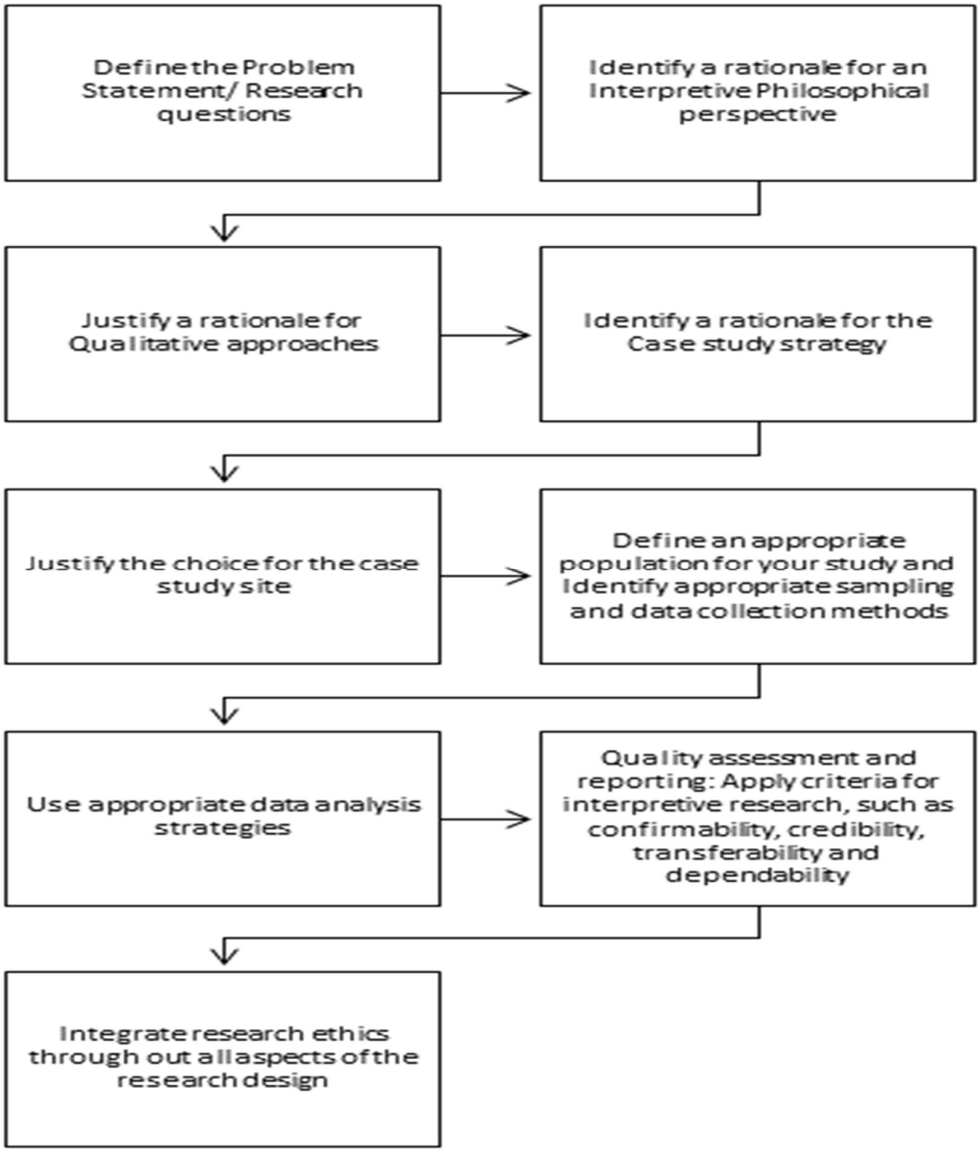


Figure 4.1: Research Methodology

Source: Derived from Walsham (2006:321-329)

The research paradigm, research approach, and research strategy used for this study are described and justification for use provided. The sampling section then details the target demographic, the case location, the sampling techniques, and the sample size. The data gathering techniques are then described, along with the tools and methodologies employed. Data analysis techniques are also offered, explaining the strategies utilised to arrive at the study's conclusions. Finally, the chapter finished by explaining the steps taken to comply with ethical research guidelines as well as the steps taken to assure the rigour, trustworthiness, and dependability of this study.

4.3 RESEARCH PARADIGM

This section examines the research paradigm or intellectual outlook that underpins this study. Every research is guided by a set of philosophical assumptions and beliefs about the universe, reality, and truth that guide the construction and understanding of knowledge about the world and research phenomena (Berezin, 2014). These assumptions and beliefs are often classified as ontological, epistemological, and methodological (Pulla & Carter, 2018). Ontology is concerned with assumptions and ideas about the physical and social worlds, as well as reality and truth. Ontology investigates the nature of empirical phenomena, reality, and truth, as well as whether reality and truth concerning empirical phenomena exist apart from an observer, such as a human observer. Three philosophical perspectives that were considered are objectivism, constructivism, and pragmatism (Morgan, 2014). These research perspectives are presented in Table 4.1.

Table 4.1: Characteristics of Objectivism, Constructivism and Pragmatism

Objectivism	Constructivism	Pragmatism
Recognises that social actors are not required components of social phenomena or meanings.	Believes that social actors create social phenomena (Dudoviskiy, 2018).	Pragmatism holds that there is no single method to learn but rather many different ways to comprehend reality (Morgan, 2014).
It holds that something cannot be proven if it cannot be consciously witnessed.	The research participant creates the universe. Individual experiences therefore assist the researcher in learning more about Green ICT.	The ontological viewpoint integrates objectivism with constructivism. According to Morgan (2014), pragmatism is more concerned with the experiencing world and its various subjective and objective levels.
The paradigm is appropriate for quantitative research.	The paradigm is appropriate for the qualitative research method.	

Constructivism was chosen as the research paradigm for this study because of its benefits and applicability to the topic and environment. As previously stated, constructivist research seeks to understand phenomena through the eyes of people being examined, in this case,

knowledge workers who use Green ICT (Kivunja, 2017). The constructivist paradigm permits the researcher and the participant to converse while gathering data, thus the investigator and the topic of the inquiry are dynamically linked, and the 'findings' are formed as the investigation progresses (Pulla & Carter, 2018). The researcher engaged participants in their natural settings for this study, and data was collected through a dialogic process in which the participants shared their experiences and perceptions about the implementation of Green ICT, drivers of Green ICT implementation, and barriers to Green ICT implementation within a large IT company in South Africa.

Using a constructivism paradigm allowed the researcher to study ICT professionals' situated experiences and their circumstances (Puller & Carter, 2018). Constructivist academics are interested in how people build meaning from and about their experiences, as well as their own experiences (Crossman, 2020). The researcher offered questions in this study that allowed participants to reflect on their experiences with Green ICT implementation, Green ICT implementation drivers, and hurdles they confront in the implementation of Green ICT inside a large IT company in South Africa. These thoughts aided in eliciting varied perspectives from participants, allowing for comparison during data processing. According to Al-Ababneh (2020), when using the constructivist method, individuals do not just absorb imprints of things and events encountered in the environment, but rather interpret these through distinct perceptual schemas.

In constructivist research, participants are viewed as unique individuals from which a research phenomenon can be understood from the participants' varied and distinct experiences (Crossman, 2020). Therefore, in understanding Green ICT implementation, the researcher relied on the lived experiences of ICT employees in the large ICT company. As a result, interpretations based on an individual's interpretations are relative and belong to the knower at the time, location, and culture in question (Al-Ababneh, 2020). As a result, knowledge is inexorably tied to the knower (Crossman, 2020). As a result, the researcher

was able to better grasp the meanings that knowledge workers attached to their experiences with Green ICT by employing constructivism in this study.

Ontology and epistemology are inextricably linked. The relationship between the researcher and reality, or how reality is captured or known, is reflected in epistemology (Killion & Fisher, 2018). Creswell and Creswell (2017) define epistemology as the philosophy of knowing that recognises suitable sources of evidence and conclusions. The three major epistemological viewpoints are interpretivism, critical realism, and positivism (Bryman, Bell, Hirschohn, Dos Santos, Du Toit, Masenge, Van Aardt, & Wagner, 2014).

4.3.1 Positivism

The positivist paradigm assumes that social phenomena and their importance exist independently from social actors (Bryman et al., 2014). According to positivists, regardless of the researcher's viewpoint or views, there is only one objective reality for each event or scenario (Killiona & Fisher, 2018). Positivism employs organised and systematic research procedures to achieve reality. Furthermore, positivism is guided by the objectivist ontology outlined above and is ideal for quantitative research methodologies (Bryman et al., 2014).

4.3.2 Interpretivism

The philosophical assertion that interpretation is a crucial component of the process of constructing meaning is known as interpretivism (Walsham, 1995; Crossman, 2020). As a result, there is no means to obtain objective information outside of thinking (Pullar & Carter, 2020). Rather than generalising and forecasting causes and effects, interpretivism seeks to understand and interpret the underlying meaning of texts obtained from interviews relating to the implementation of Green ICT, Green ICT implementation drivers, and barriers

encountered in the implementation of Green ICT within a large South African IT company. Interpretivism is informed by constructivist ontology.

4.3.3 Critical realism

Critical realism is the philosophical point of view that there are two ways to view the world: physically and intellectually (Killiona & Fisher, 2018). The mental world impacts the physical world, according to critical realists, and people can only grasp the social world by knowing the structures that give birth to events (Brant and Panjwani, 2015). The purpose of critical realism is to allow social scientists to generate new knowledge that is focused on comprehending actual events. The universe, according to critical realists, is split into three separate categories: the real, the actual, and the empirical. This may require developing answers and interventions for real-world challenges. According to Bhasker (2013), the basic goal of critical realism is to find causal links. Furthermore, critical realism allows the researcher to discover the underlying causes of a problem and conceptualise a remedy (Wisdom & Creswell, 2013). Critical realism was not considered for the research due to scheduling restrictions.

4.3.4 Paradigm selected for the study

This study used interpretivism to better comprehend knowledge workers' Green ICT practises. Interpretivism holds that the empirical world's reality is socially built, and that knowledge about the empirical world is subjectively perceived as each person develops their reality via their lived experiences (Bryman, 2015). Because reality is produced via lived experiences and is thus contextual, the interpretivist approach focuses on subjectivity, inter-subjectivity, and personal interpretation (Berezin, 2014). This study used interpretivism to better comprehend knowledge workers' Green ICT practises. Interpretivism holds that the

empirical world's reality is socially built, and that knowledge about the empirical world is subjectively perceived as each person develops their reality via their lived experiences (Bryman, 2015). As the reality is produced via lived experiences and is thus contextual, the interpretivist approach focuses on subjectivity, inter-subjectivity, and personal interpretation (Berezin, 2014). In this study, knowledge workers were asked to describe their perspectives of Green ICT implementation, Green ICT implementation motivations, and impediments to Green ICT implementation within a big IT organisation in South Africa.

In this study, knowledge workers at a large IT company in South Africa were asked to express their opinions on Green ICT implementation, Green ICT implementation motives, and hurdles to Green ICT implementation. As a result, each participant's perceptions were seen as subjective and hence unchallengeable (Wisdom & Creswell, 2013). The interpretivist approach was chosen because it allows the researcher to probe rich and thick insights and gain a deeper understanding of the implementation of Green ICT, Green ICT implementation drivers, and barriers they face in the implementation of Green ICT within a large South African IT company.

Green ICT practises are measures taken to secure the long-term usage of technology in the business and at home. As a result, interpretivism, which is based on subjective human experiences, was the greatest fit for this study (Bryman, 2015). The method enabled the researcher to derive shared meanings from the perspectives expressed by study participants during the interviews. In other words, interpretivism holds that human behaviours (such as the adoption of Green ICT systems) are influenced by the meanings we assign to events, and that meanings are produced by interactions with the phenomena (Schurink & Fouché, 2021). As a result, the interpretivist IS researcher must make methodological decisions that allow for the development of interpretative knowledge.

Furthermore, interpretivism was perfect for this research since it allowed for understanding the challenges to radical Green ICT transformation in major organisations. To get

meaningful insights on the drivers and barriers to effective implementation, it is vital to understand the implementation method. As a result, success determinants for implementation will be located within the organisational, technological, environmental, and social settings impacted by Green ICT activities.

Second, understanding Green ICT and how humans form meanings and engage with Green ICT in their natural organisational settings is required (Shamil, 2021). As a result, an interpretative approach enables us to produce interpretive knowledge about Green ICT while also acquiring a better understanding of the success elements in the organisational social contexts in which knowledge workers in major organisations engage with Green ICT (Crossman, 2020).

4.4 RESEARCH APPROACH

According to Gupta and Awasthy (2015), the research approach is the technique and plan that consists of general assumptions for detailed methods of data collection, analysis, and interpretation. Creswell and Poth (2018) classify research approaches into three types: qualitative, quantitative, and hybrid research.

Qualitative research, according to Wisdom and Creswell (2013), is a process that comprises obtaining, processing, and interpreting non-numerical data, such as language. Qualitative research employs an interpretative, naturalistic approach to grasp a phenomenon (Aspers & Corte, 2019). Qualitative research investigates a phenomenon in its natural setting with the purpose of understanding or interpreting it in light of the meanings that people ascribe to it (Berezin, 2014). When a researcher seeks to understand how a person understands and gives meaning to their social surroundings, this technique is particularly effective (Aspers and Corte, 2019).

Quantitative research, on the other hand, is an examination into a recognised phenomenon that is focused on testing a hypothesis, measuring it using data, and utilising statistical tools (Shorten & Smith, 2017). Quantitative research tries to determine the accuracy of a theory's prediction generalisations (Wisdom & Creswell, 2013). The goals of quantitative research are to test causal relationships between variables, make predictions, and extrapolate the results to a wider population (Aspers & Coerte, 2019). Statistics are regarded to be reasonable and scientifically objective when applied to assess quantitative data (Wisdom & Creswell, 2013).

As previously stated, both the qualitative and quantitative methodologies contain weaknesses that impact the dependability of the data acquired and the validity of the results. Shorten and Smith (2017) designed the mixed-methods research to overcome the drawbacks of the qualitative and quantitative techniques. According to Creswell and Hirose (2019), mixed methods research is a research approach that involves the methodical integration of quantitative and qualitative data within a single inquiry. Rather than using a purely quantitative or qualitative strategy, mixing qualitative and quantitative methodologies allows for full and synergistic data exploitation (Shorten & Smith, 2017). Due to time and cost constraints, the mixed method approach was not explored for this study, despite its benefits.

4.4.1 Research approach selected for the study

The qualitative research method was used for this study. The qualitative research technique focuses on observations, thoughts, behaviours, and occurrences to collect rich, comprehensive information that enlightens the researcher on the topic under investigation (Schurink & Fouché, 2021). In quantitative research, unstructured or semi-structured interviews and observations are employed, according to Reiter (2017). According to Sixas, Smith, and Mitton (2017), qualitative research allows for the acquisition of crucial data since

it focuses on patterns of conduct. However, according to Bryman (2015), qualitative research lacks impartiality, is expensive, and takes a long time to handle.

The qualitative research approach entails gathering and analysing non-numerical data in order to fully comprehend the thinking patterns, concerns, behaviour, attitudes, views, and beliefs of individuals and groups that the quantitative approach cannot provide (Sileyew, 2019). As a consequence, the qualitative technique was used in this study to successfully fulfil the research goals. The qualitative approach was required because it allowed for the exploration of the phenomenon and the collection of in-depth data based on the perspectives of participants on the implementation of Green ICT, Green ICT implementation drivers, and barriers to Green ICT implementation within a large South African ICT company. The next section goes through the study's research design.

4.5 RESEARCH DESIGN

Research design generally “refers to the framework or structural tactic which is used in assimilating unquantifiable mechanisms of the investigation in a consistent and systematic routine actuality in rendering precise completion of the objectives (Banks & Zeitlyn, 2015). The research design puts a predetermined channel of action which will be undertaken in gathering information, its capacity, and its structure (Bailey & Burch, 2017). It is the problematical part of the research that requires the choosing of the research design to be used. A research plan is very significant as it results in the efficient completion of the research objectives (Bryman, 2015). Research design is determined by the philosophy or paradigm of the research chosen which is in turn influenced by the nature of the research problem (Bryman, 2015).

There are four main types of research designs: survey, explanatory, exploratory, and descriptive. Qualitative and quantitative research both benefit from descriptive research

designs. The word "descriptive" comes from how the study topics, research designs, and data analysis were chosen (Fluet, 2021). Descriptive studies focus on establishing "what is." This is accomplished by using visual aids, such as graphs and charts, to help the reader comprehend the distribution of the data (Sixas et al., 2017).

4.5.1 Exploratory design

An exploratory design is employed when investigating a problem that has not been examined before or has not been adequately explained (Shamil, 2021). An exploratory design is used to investigate a phenomenon that is not yet fully understood (Reiter, 2017). An exploratory design helps the researcher gain a deeper knowledge of the problem at hand but does not produce definitive results (Reiter, 2017). According to Saunders, Lewis and Thornhill (2016), exploratory research is usually conducted through individual in-depth interviews comprising open-ended questions and/or through observation. First-hand primary data is obtained utilising this research design. It permits the investigators to enrich and widen their knowledge (Schwandt, 2014). This can be used as a preliminary test to expose the likelihood of larger-scale-succeeding research (Sekaran and Bougie, 2016). One advantage of the exploratory design is that it is pragmatic in the preliminary stages of investigating the problem (Creswell & Creswell, 2017). Therefore, the design seeks to provide a conceptual foundation for research to be carried out (Smith, 2015). It is concentrated on acquiring awareness and insight regarding a particular problem to determine if it warrants further research (Taylor, Bogdan & DeVault, 2015).

4.5.2 Explanatory design

In explanatory research designs, the researcher attempts to draw relationships between different ideas and to have a better understanding of the different reasons, causes, and

effects (Shamil, 2021). Explanatory research commonly seeks to understand why a phenomenon is (Creswell & Creswell, 2017). This study was primarily focused on how Green ICT is implemented using different strategies and the factors that influence the implementation thereof. Therefore, an explanatory design was not ideal for the study.

4.5.3 Survey design

A survey research design is a technique for gathering data from a group of people by posing several questions about a phenomenon. An effective method for determining the attitudes and orientations of a study population is using surveys (Creswell & Hirose, 2019). The questionnaire and the interview are the two main types of survey designs. Traditional survey items are quantitative, but researchers may include qualitative components through open-ended questions (Creswell & Hirose, 2019). The two main survey design types are longitudinal and cross-sectional surveys. A cross-sectional survey is undertaken and completed once, while a longitudinal survey is undertaken over some time (Fowler, 2014).

4.5.4 Case study design

Yin (2018) defines a case study as a research design that focuses on the exploration of objects, people, events, organisations, or groups (Yin, 2018). Two types of case studies, a single case study or a multiple case study can be used in qualitative research. A single case study focuses on one organisation, while a multiple case study focuses on many organisations or institutions in the same study (Gaya, 2018). A case design is appropriate for qualitative research in that it allowed an in-depth exploration and gathering of detailed information from participants on a phenomenon (Yin, 2018).

4.5.5 Research design selected for the study

To gain a greater understanding of the implementation of Green ICT, Green ICT implementation drivers, and barriers faced in the implementation of Green ICT within a large ICT company in South Africa, the study utilised a single case study. The adoption of a single case study design helped in gaining insight into the implementation of Green ICT, Green ICT implementation drivers, and barriers faced in the implementation of Green ICT within the large ICT company in South Africa, the study utilised a single case study (Hammersley, 2012). In addition, the use of a single case study guided the choice of relevant data collection methods, sampling methods and participants (Creswell, 2007).

4.6 CASE SITE DESCRIPTION

The first part of this chapter is devoted to describing the rationale for the research design for this research. This included a justification for the interpretive research paradigm and the appropriateness of a qualitative approach, culminating in the rationale for an interpretive case study research strategy. The second part of this chapter details the methodological choices that were made to implement the research design, starting with a description of the case study site, and the sampling, data collection and analysis methods. The next two sections provide a brief background of the case organisation and the rationale for choosing the case organisation.

4.6.1 Background of the Case Organisation

The case study site for this research was at a large ICT company in South Africa. The organisation is one of the largest players in South Africa's professional technology services sector operating under the Consulting, Technology and Outsourcing model in at least 120 locations across different markets in the Sub-Sahara Africa region and Europe and the

Middle East. This large ICT company in South Africa employs over 8000 mostly highly skilled employees and middle to senior managers across its 20 different subsidiaries. The Group's subsidiaries serve a portfolio of at least 4 000 enterprise customers in local and global markets spanning all significant industry sectors from health, education, communication, transport, mining, business, and governance to mention just a few. This portfolio includes clients in both the private and public sectors such as municipal governments, provincial and national government departments and listed blue-chip companies.

The core services offered by the large ICT company in South Africa are rooted in the ICT sector. Some of the key projects delivered by the organisation over the years that resemble the organisation's capabilities include the provision of traditional ICT infrastructure, networking infrastructure services, deployment and maintenance of cloud infrastructure, and major software development and maintenance projects in the banking, insurance, education, and health sectors amongst others. In recent years, key projects have included spearheading cloud migration of various information systems for several clients and developing and selling cloud-based software products for enterprises. Additionally, some of the organisation's major acquisitions in recent years have enabled a large ICT company in South Africa to expand the scope of its services beyond its traditional scope to include complimentary services such as engineering, backup power and renewable energy systems.

Since enlisting in the Johannesburg Stock Exchange (JSE) towards the end of the twentieth century, the large ICT company in South Africa embarked on an aggressive acquisition strategy to help with growth and expansion resulting in over two hundred legal entities at its peak. These acquisitions included subsidiary complementary companies and key intellectual property companies. However, towards the end of the second decade after the JSE listing, the organisation underwent a major organisational crisis resulting in an organisational change that included a restructuring process and the disposal of some of its major acquisitions. The large ICT company in South Africa announced a new turnaround

strategy along with the new appointments that were focused on sustainable growth, governance, compliance, and streamlining operations.

4.6.2 The rationale for choosing the case organisation.

The large ICT company in South Africa was selected as the case site on two grounds. Firstly, the organisation operates under the consulting, technology and outsourcing model and therefore employs a large pool of knowledge workers and professionals to serve its clients. The large ICT company in South Africa's pool of talent includes consultants, operational ICT specialists, data analysts and engineers who have expansive knowledge and experience in the use and application of information systems within the context of the organisation as well as its diverse client base. The employees would therefore serve as key informants to provide insights on the use and application of information systems as well as the inclusion of Green ICT in company projects and client works. By taking observations from a large ICT company in South Africa's talent pool, it was assumed the study would gain insight into the factors influencing the implementation or lack of implementation of Green ICT in large entities.

Secondly, before the commencement of this study, a large ICT company in South Africa had gone through a restructuring process, emerging from the organisational change process with a commitment to sustainable growth through a newly formulated turnaround strategy grounded in a new Governance, Risk and Compliance (GRC) framework. As indicated in the literature, Green ICT is intricately linked to corporate governance and compliance as more governments step up efforts to regulate compliance with environmental standards and regulations across different industries such as the technology sector (Radu, 2018; Irfan & Putra, 2020). In addition, it has been established in the literature that sustainable growth ought to consider the trilogy of financial and economic, environmental, and social aspects of sustainability (Butler et al., 2015; Esfahani et al., 2018). It was therefore assumed that the turnaround strategy for sustainable growth would encompass all three elements of

sustainability and, provide useful insights on the operationalisation of Green ICT since a large ICT company in South Africa is an industry leader in the ICT sector. This large ICT company in South Africa was therefore considered an appropriate case to focus on evidence on the inclusion of Green ICT implementation as part of the corporate strategies to achieve sustainable business growth. Coupled with the data collection for this study, the organisation provided an appropriate case to investigate Green ICT implementation in the aftermath of an organisational change and amid a recovery period from the COVID-19 pandemic crisis.

4.7 TARGET POPULATION

A target population refers to the whole collection of elements or people from which a group of a few elements or people are selected to participate in a particular study (Creswell & Poth, 2018). The target population for this study comprises knowledge workers employed in highly skilled, middle managers and senior managerial roles, in the ICT industry.

4.8 SAMPLING

According to Schwandt (2014), sampling is a method by which a researcher chooses individuals from a sizable population or group of people to create a subdivision that may be used to estimate and infer the characteristics of a particular division. According to Sekaran and Bougie (2016), improper sampling will negatively impact the study's conclusion. There are two categories of sampling techniques: probability sampling and non-probability sampling. In probability sampling, each member has a non-zero probability of being chosen (Sharma, 2017:749). Using a technique called non-probability sampling, individuals are chosen from the population in a non-random manner (Taherdoost, 2016:20). Non-probability sampling can take many different forms, including convenience sampling, judgement sampling, quota sampling, and snowball sampling as indicated in table 4.3.

Table 4.2: Types of sampling

Sampling method	Description
Convenience sampling	This approach is typically used in exploratory research where the researcher wants to get an idea of the truth. Convenience sampling is often done in preliminary research to get estimates of results without incurring expenses (Sharma, 2017).
Purposive sampling	In this type of sampling, the researcher chooses a sample on the bases of judgement (Benoot, Hannes & Bilsen, 2016). The researcher may choose to select the entire sample in this situation from a representative sample of the population (Benoot et al., 2016). The technique saves money because the researcher can analyse the whole based on a sample of a representative population they have chosen, but the sample they have chosen needs to be carefully chosen to be truly representative of the entire population.
Quota sampling	This method involves the identification of strata and their proportions as represented in the population (Benoot et al., 2016). The expected number of

	subjects from each stratum can then be determined by the researcher using convenience or judgement sampling. It was not considered for this study as the population of interest were knowledge workers in a selected organisation. These knowledge workers are a group of ICT experts and there was no other stratum of interest.
Snowball sampling	Snowball sampling is useful when the characteristics of the desired population are rare (Sharma, 2017). Therefore, to find the participants, the researcher may rely on referrals. Participants for this study were identified at the organisation where they work, thus snowball sampling was not considered.

4.8.1 Chosen Sampling method

For this study, non-probability sampling was employed to select the participants based on their knowledge of Green ICT (Sharma, 2017). Purposive sampling entails the selection of a sample with a researcher having prior knowledge of a certain group of individuals with certain characteristics useful to the phenomenon under investigation (Taherdoost, 2016; Robinson, 2014). Purposive sampling was used to select 26 individuals from the target population based on their knowledge and expertise in a large ICT company in South Africa's ICT and sustainable practices. These Individuals are involved in decision-making processes within the organisation.

4.8.2 Sample size

According to Flick (2015), a study population is necessary for conducting qualitative research as it is cost-effective and less time-consuming than using a whole population. A sample size of between five and ten individuals in qualitative research is deemed adequate to attain data saturation (Gentles, Charles, Ploeg & McKibbon, 2015). The sample size of 26 for this study is presented in Table 4.2 below.

Table 4.3: Distribution of sample for the study

Job position of participant	Number of participants
Highly Skilled participants	11
Middle Managers	9
Senior Managers (directors)	6

This research utilised a sample of 26 individuals to collect qualitative primary data that is comprehensive and highly detailed.

4.9 DATA COLLECTION

To collect data for the study, a data collection instrument is required. A data collection instrument is a tool used to obtain, measure, and analyse data from participants identified for the research (Steph, Ger, Gaast, Keestra & Koenders 2021).

Since this research adopted the GITAM model and qualitative research approach, the data collection instrument employed for this study was semi-structured interviews based on an

interview guide with open-ended questions administered through video conferencing on Zoom. The use of interviews as a data collection instrument allowed the researcher to apply the GITAM model in understanding the Green ICT context, Green ICT drivers, barriers, Green ICT readiness, and Green ICT intention and adoption in the case organisation. In addition, interviews helped the researcher to question and probe participants' respondents to give an in-depth exploration of the implementation of Green ICT, Green ICT implementation drivers, and barriers faced in the implementation of Green ICT within a large ICT company in South Africa (Hewson & Stewart, 2016). It gave the researcher the ability to deduce what the participant had in mind due to verbal and non-verbal actions including body language, and tone of voice. One-on-one interviews foster the generation of detailed and prime information from the participants (Hewson & Stewart, 2016). Face-to-face interviews, even those conducted using video conferencing, give room for participants to elaborate their answers empowering the researcher to attain profound and detailed information about the research phenomenon since participants can clarify them (Leavy, 2017; Lampard & Pole, 2015).

On the other hand, face-to-face interviews have the disadvantage of being expensive to conduct as they require one to travel to conduct them. They require extensively skilled personnel to conduct them, as the outcome depends on the interviewer's expertise (Leavy, 2017). Additionally, because recording and transcribing the information is carried out manually, it becomes quite laborious and time-consuming (Klenke, 2016). However, the use of video conferencing and a manageable sample size of 26 participants in this research, reduced the costs associated with collecting data.

The open-ended interview, which was the instrument for this study, was developed from the research objectives and research questions as well as the GITAM model. The interview guide had 16 questions. The first question (1) asked if the participant would grant consent by answering 'Yes or No'. Questions 2 to 4 were related to the participant profile. Questions 5 to 16 focused on the research questions as indicated in Table 4.4.

Table 4.4: How the interview questions addressed the research questions

Research question	Interview question(s)
Consent	I understand my right to choose whether to participate in the research project and that the information provided will be handled confidentially. I am aware that the results of the interview may be used for academic publication.
Participant profile	How long have you been working for a large ICT company in South Africa? What is your role in a large ICT company in South Africa? What are your day-to-day activities in a large ICT company in South Africa?
Green ICT context	
What are the current approaches used in the implementation of Green ICT?	What is your understanding of Green ICT and how is it viewed within your organisation?

	What Green ICT implementation Which strategies do you use, if any, within your organisation? How has the COVID-19 context impacted Green ICT implementation in a large ICT company in South Africa? What are the Green ICT practices you have implemented? Why?
Green ICT readiness	
How do you assess your readiness for Green ICT?	Overall, how do you rate the readiness of your organisation for Green ICT implementation? How do you determine the successful implementation of Green ICT? What are the challenges or barriers to implementing Green ICT within your organisation? In your opinion, what are the possible solutions to the challenges you face in implementing Green ICT within your organisation?

Green ICT drivers	
What are the drivers of the implementation of Green ICT within a large IT company in South Africa, South Africa?	Does your role allow you to influence ICT Policies within a large ICT company in South Africa? What is the importance of implementing Green ICT within your organisation? What are the drivers of implementing Green ICT within your organisation? What are the benefits of implementing Green ICT within your organisation?

Table 4.3 indicates the interview questions that corresponded with each of the three research questions for the study. The distribution of the interview questions indicates that all research questions were addressed by the interview. The next section describes the procedure for data collection.

4.9.1 Procedure for data collection

In line with ethical practice, the following steps in Figure 4.3 were taken during the data collection.

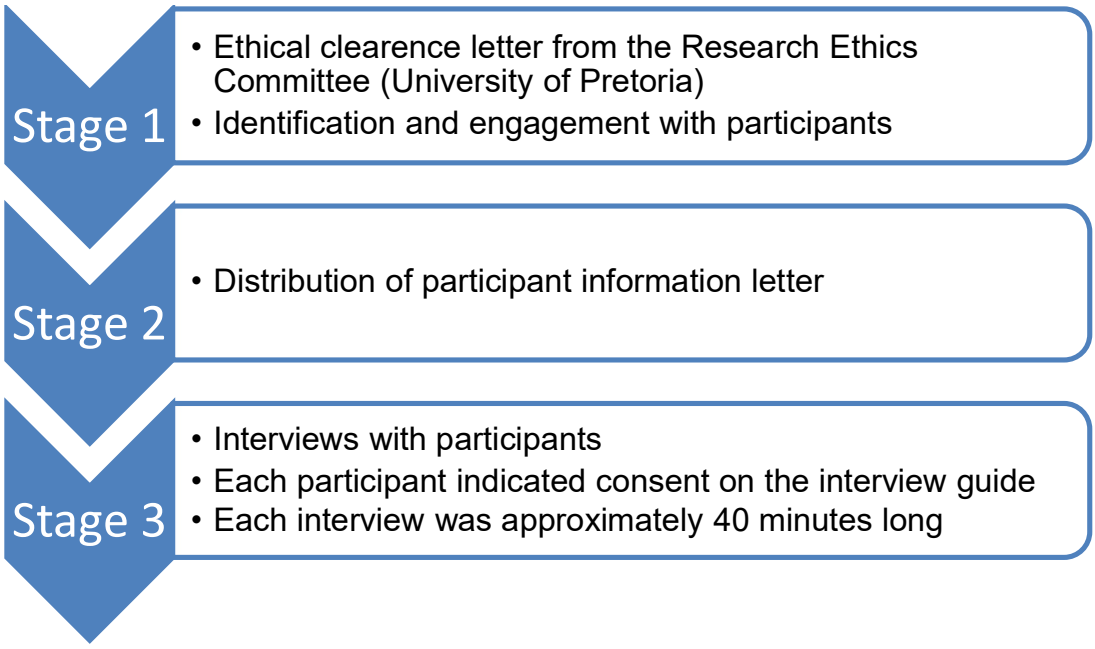


Figure 4.3: Procedure for data collection

In Stage 1, the researcher received a letter of ethical clearance from the University of Pretoria's Research Ethics Committee (see Appendix F). The letter gave the researcher permission to speak with participants and interview them. The researcher presented the ethics clearance letter to the large ICT company in South Africa's manager to seek permission to select and engage the company's employees for the interview. The request was granted, then the researcher was presented with the company's organogram from which highly skilled participants occupying technical roles, middle managers and senior managers were identified.

Stage 2 involved the distribution of participant information letters (see Appendix C). The letter outlined the purpose of the research, the role of the researcher, the role of the participant, and the ethical issues to be adhered to. Thereafter, the researcher proceeded with the interviews (Appendix D).

26 participants were contacted in advance to schedule their participation in the interviews. They were involved in the administration of the interviews. Before the interviews began, the participants received a brief explanation of the study, a cover letter, and a permission form outlining their rights, which they were required to electronically sign. The interviews were conducted using video conferences.

The written interview questions were used as a framework for asking follow-up questions and allowing respondents to thoroughly clarify their answers. Core questions about how Green ICT was implemented at the organisation served as the framework for the open-ended interview. The interview aimed to elicit information about the organisation's adoption of Green ICT practices and how these practices relate to the corporate strategy of the organisation. Additional information was also provided regarding how the pandemic outbreak and the subsequent response affected the Green ICT initiatives.

4.10 DATA ANALYSIS

Data analysis in qualitative research is the methodical use of interpretive approaches to explain and demonstrate, condense, recapitulate, and assess data (Braun & Clark, 2019). The data in this study were analysed using thematic analysis. Thematic Analysis is a collection of research methodologies used to investigate a phenomenon by categorising and carefully analysing it (Creswell & Poth, 2018). In this situation, the researcher analysed the texts as the primary source material.

There are several reasons why the thematic analysis was chosen for this study. Firstly, in line with the interpretivist paradigm, thematic analysis was ideal for the researcher to analyse and make sense of communal or shared meanings and experiences of knowledge workers who were recruited for interviews (Braun & Clarke, 2019). In addition, thematic analysis assisted the researcher in identifying the characteristics or variables that influence

any views expressed by participants relating to Green ICT. For this inquiry, the researcher used an inductive approach to data coding and analysis. According to Braun and Clarke (2019), the 'bottom' technique is motivated by facts. This means that the codes and themes are derived directly from the substance of the data.

The thematic analysis involved organising and interpreting raw data to understand and generate themes that reflect the factors related to the adoption of Green ICT (Ravitch & Car, 2016). In the case of study research, appropriate and thorough procedures were typically adopted to support a well-managed process of data analysis. The advice provided by Flemming (2017) on how to gather and use theme analysis to analyse qualitative data was very helpful in completing this task.

4.10.1 Thematic analysis procedure

The interviews were conducted in English via video conferencing platforms, recorded, and transcribed in preparation for analysis in ATLAS.ti. Voice recordings from the semi-structured interviews were transcribed manually. The searcher listened to each of the transcripts and typed the conversations in a Word document.

Before analysis, the transcripts were proofread and edited for grammatical errors. The final transcripts were then reviewed independently against the recordings to verify the accuracy of the transcripts. The next step involved managing the research data. ATLAS.ti version 22 is not only computer-assisted qualitative data analysis software, but the software also comes with powerful data management functionalities for storing, handling, and managing various types of research data. The software functionalities allow it to handle different media formats from text documents, audio, video, and image files as well as survey data. The thematic analysis process is indicated in Figure.4 below.

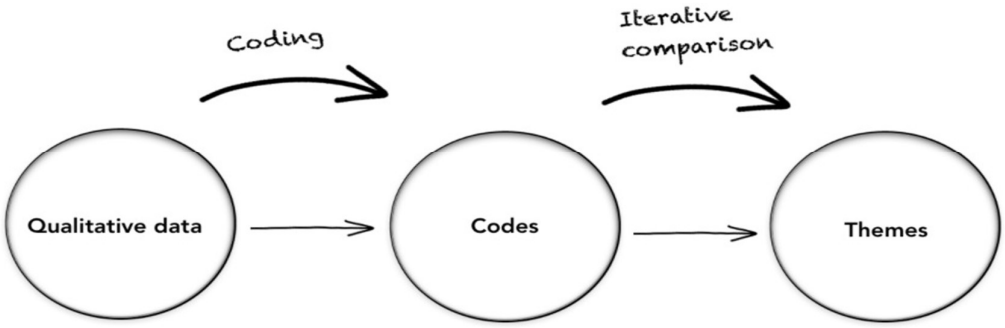


Figure 4.3: The thematic analysis process derived from Braun and Clark (2006)

Using Atlas.ti software, a coding agenda was used to identify and describe preliminary categories, which included variables that aligned with the research questions. Coding rules were devised to separate the categories. Following that, the researcher read the transcripts and highlighted any statements that appeared to be significant at first look. The material of the transcript was organised using a colour scheme after reviewing the established categories (Creswell & Creswell, 2017). The obtained data were then analysed and interpreted, and themes were generated following six stages recommended by Braun and Clark (2006).

Step 1: Familiarising with the data

The researcher began by familiarising himself with the transcripts as recommended by Braun and Clark (2006). This process involved reading the transcripts and re-reading them. During this initial process, the researcher was writing down initial impressions that emerged from the transcripts.

Step 2 Generating initial codes

The first step in the coding process was to develop initial codes by organising raw data to make sense. The researcher starts by performing line-by-line open coding of the data, comparing incidences to one another in the data, coding the data in every way conceivable, and asking the data a series of questions (Braun & Clark, 2006). Examples of the questions include defining the study's purpose, categorising data occurrences, exploring what is happening in the data, and exploring the participants' top issues and suggested solutions (Fleming, 2017) These questions support the researcher's theoretical awareness, go beyond the specifics of the description, and promote attention to patterns among the episodes that produce codes. In open coding, concepts and essential words are found, highlighted, and moved into subcategories before being placed into categories (Braun & Clark, 2019). The researcher then began to theorise, reflect on what he was reading and learning, and compare the data because the material was being broken down into conceptual components. Additionally, during open coding, the researcher segmented data into distinct pieces and carefully scrutinised each piece to pinpoint concepts and dimensions of emergent phenomena.

Step 3: Searching for themes

The term theme refers to a pattern that encapsulates a key or intriguing aspect of the data or research subject (Maguire & Delahunt, 2017). According to Braun and Clarke (2006), there are no strict guidelines as to what constitutes a theme. The importance of a theme defines it. After coding, the next step was to sort and summarise material with the same codes and identify themes. The researcher established links and linkages between the categories. Searching for themes includes more theoretical reasoning and analytical induction than open coding, which is more descriptive. To synthesise and arrange data into more logical, hierarchically structured categories and subcategories that give complexity and dimension to emergent concepts and their potential relationship to other framework

elements, axial coding offers a coding framework or template (Braun & Clarke (2006). Consideration and the development of links between working categories and subcategories are the goals of this analytical phase, which aims to capture both the general characteristics of a phenomenon and dimensional variation (Maguire & Delahunt, 2017).

Step 4: Reviewing themes

This stage involved reviewing more data for themes (Maguire & Delahunt, 2017). The process involved continuously reviewing, altering, and modifying preliminary themes to ensure that the themes responded to the research questions as indicated in Table 4.5.

In some cases, a three-level code structure could not be maintained, and sub-code categories were introduced into the coding scheme. To illustrate the coding process, **Error! Reference source not found.**.5 shows a snippet from the ATLAS.ti CAQDAS showing an excerpt from a coded transcript. The snippet shows the interviewer's question in bold, and the final codes attached to the relevant responses from the interviewee. Paragraph 11 (shown in the margins of **Error! Reference source not found.**.5) shows an example of code co-occurrence where the code "Governance: Cost reduction" from the "DRIVERS" code category overlaps with the codes "Enforcement of power management features" and "Cloud Technology" under the "TECHNOLOGY" and "PRACTICES" code categories.

As will be discussed in further detail in the next two chapters, this snippet demonstrates the development of the concept of how the need to reduce operational costs influences a combination of green practices and the adoption of green technologies to reduce the energy consumption of ICT infrastructure. Table 4.5 indicates the emerging themes.

Table 4.5: Emerging themes from the data

Code	Sub-Categories	Category
Attitude	Business Attitude Concern about climate change Concern about reducing ICT's power usage Concerns about sustainable development Lack of concern about climate change Lack of education and awareness Resistance to change	Green ICT readiness
Policy	No articulated policy	Green ICT drivers
Drivers	Change attitudes. Response to emergency Education and Awareness Innovation	Green ICT drivers

Governance Drivers	Corporate social responsibility Cost reduction Improve Value offering for green Business clients. Industry standards Regulations	Green ICT drivers
Solutions	Green ICT policy framework Innovation Innovation Solutions: Recruitment Allocation of budgetary and other resources Clearly defined roles, responsibilities, accountability, and control for Green IT initiatives	Green ICT context Green ICT readiness

This coding scheme and analytical framework were applied and matched with other excerpts representing similar meanings to develop the concepts and themes of the study. The emergent concepts and themes were then compared with the evidence collected in the literature to verify the analytic generalizations of the evidence.

Table 4.6 shows how Atlas 2.2 was used to interpret the data that was collected from the interviews that were carried out.

Table 4.6: ATLAS.ti qualitative analysis

Code Count	The number of times the main theme occurs
Code per Document	It shows the number of themes per selected document
Word Count	Determines the most commonly occurring words in selected or all documents by showing their occurrence count.
Network	In addition to codes, a network will allow further grouping of codes and expand by adding codes or quotes for further analysis or presentation of qualitative information (see appendices)

A coding schema guided the data analysis of the data, with distinct codes derived from the GITAM model to derive the six final themes, as indicated in Table 4.6. The resulting coding framework comprised code, sub-categories and categories groups as detailed in the table below.

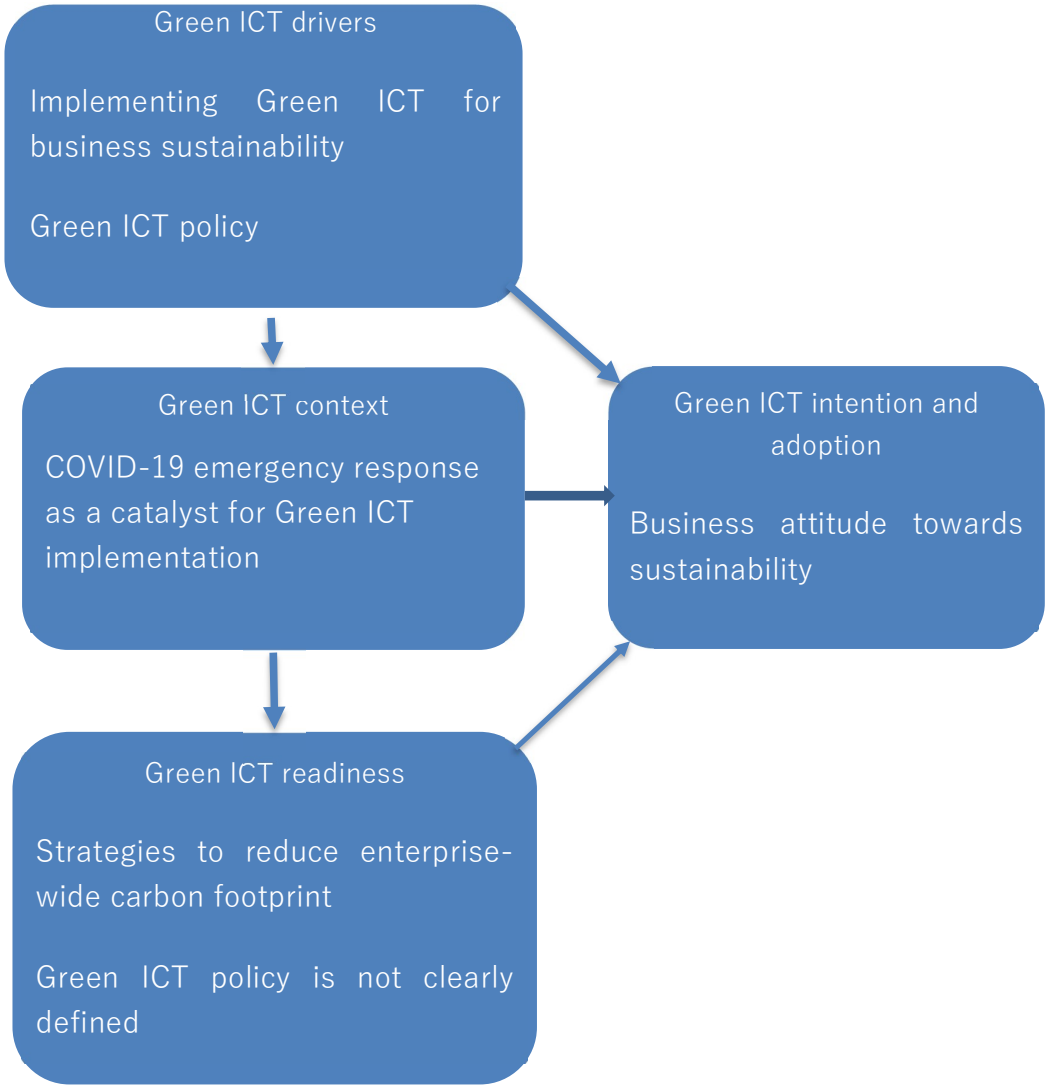


Figure 4.4: Thematic map in line with GITAM model

Source: Derived from the themes

Reading the data related to each topic at this level involved evaluating if the data supported it. The next stage was to consider if the themes fit within the overall framework of the entire set of data.

Step 5: Defining themes

Finally, the following six themes were derived from the coded data as shown in Figure 4.5 below. The themes will be discussed in detail the chapters five and six.

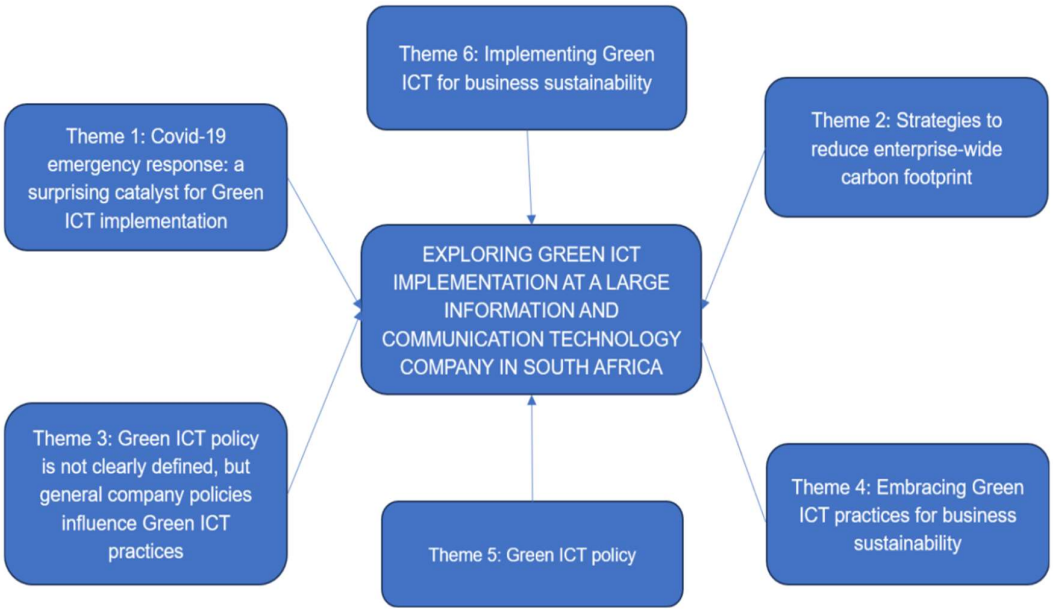


Figure 4.5: Six final visual themes diagram

For further analysis of the collected data based on the codes and quotations from the interview process, ATLAS.ti created network diagrams to visualise the valuable in-depth data that was collected as shown in figure 4.6 below.

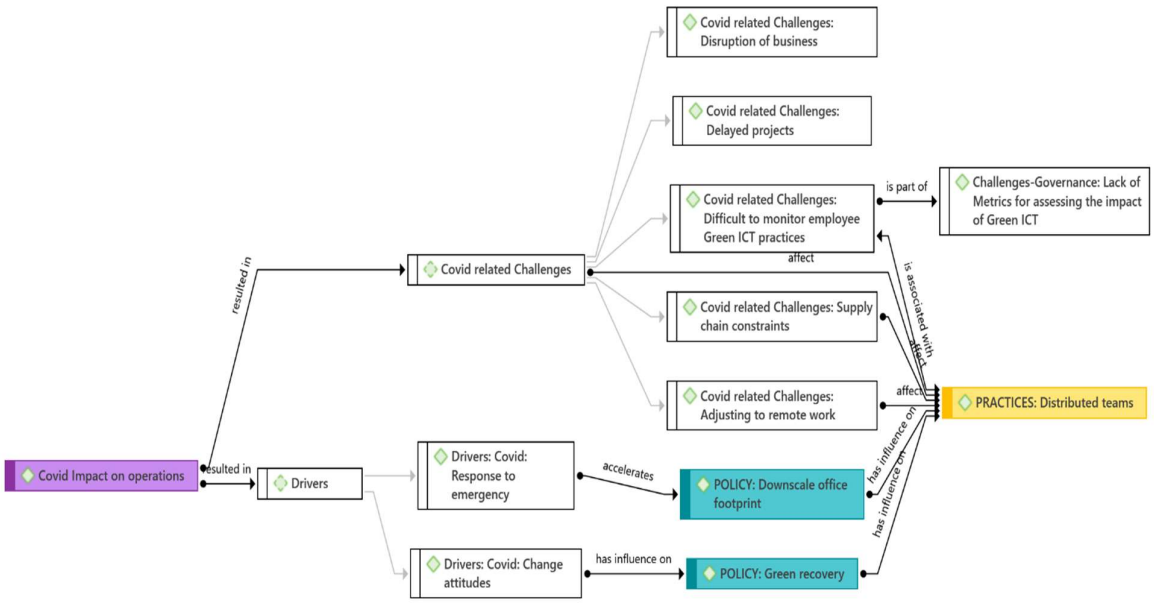


Figure 4.6: ATLAS.ti network diagram of the relations showing impact of covid-19 pandemic on supply chain related challenges, policy, and Green ICT practices

Source: Derived from the thematic analysis

Step 6: Write up

The themes established from the thematic analysis process were used to present research findings in chapter 5.

4.11 CREDIBILITY AND RELIABILITY

Credibility is defined as the confidence that can be placed in the truth of the research findings (Silverman, 2013). In assessing the credibility of a research project, researchers must consider what was done during data collection, in the formation of an interpretation, and in the presentation of the final interpretation to readers. Reliability refers to a way of ensuring that an instrument used for measuring experimental variables yield consistent results every time on similar respondents (Aspers & Corte, 2019). Table 4.7 outlines the actions that were taken.

Table 4.7: Measures taken to ensure credibility and reliability

Credibility	**Reliability**
To enhance credibility, the researcher undertook prolonged engagement during the interviews (Middleton, 2019).	The reliability of the interview questions was enhanced by using field notes during data collection
The researcher debriefed the findings by the supervisor. The researcher also carried out member checks to allow the participants to validate the findings.	The researcher used a sound recorder to ensure that every part of the interview was captured and transcribed.
An audit trail was presented in the form of a concise methodological process and the justification for each of the choices in the methodology chapter (chapter 4).	The study clearly outlined the research design and its implementation, indicating what had been planned and what had been executed.

4.11.1 Trustworthiness

Any research approach, regardless of the philosophy of science from which it emanates, requires ways to assess the trustworthiness of the study. The specific criteria used to determine trustworthiness vary greatly depending on the research approach and guiding principles used (Middleton, 2019). Its significance is seen as being scientifically universal. According to Middleton (2019), there are four trustworthiness-related questions that are crucial for any type of investigation. These inquiries are posed:

- How do we know whether to have confidence in the findings?
- How can we determine how much the findings hold true in other situations?
- If the study could be performed essentially in the same way, how do we know the results would be the same?
- How can we tell whether the findings come more from the context and the respondents than just the researcher?

Credibility, transferability, dependability, compatibility, and integrity are the five main aspects that determine if a qualitative study is reliable, according to Schurink and Fouché (2021). Recognizing whether research findings are valid interpretations of participants' initial perspectives and represent credible information generated from their original data requires credibility, according to Reiter (2017). Thus, by implementing the following six credibility indicators, a qualitative researcher can demonstrate the rigour of the investigation: sustained fieldwork and research participation, peer debriefing, triangulation, member-checks, negative case analysis, and persistent observation (Middleton, 2019). Long-term involvement on the part of the researcher sparked better understanding of the tactics employed to deploy Green ICT.

This study met the necessary quality standards for transferability, dependability, and compatibility, ensuring the reliability of the study results. The steps taken to achieve the standards for trustworthiness are described in the sections below for transferability, dependability, and compatibility.

4.11.2 Transferability

Transferability is the interpretive equivalent of generalisability and refers to the extent to which findings from qualitative research may be used in different situations with different respondents (Aspers & Corte, 2019). Using Middleton's (2019) recommendation, the researcher provided descriptions of the methodological choices and procedures such as the choice of the research design, population, sampling type and data collection instrument. In addition, the study provided thick descriptions to explain every step of the research process, from data collection and study background to the creation of the final report by the researcher (Aspers & Corte, 2019). According to Schurink and Fouché (2021), a thick description focuses not only on the behaviour and experience but also the background of participants, to make the behaviour and experience intelligible to the outsider. The researcher made sure that enough context and depth were included in the reports and descriptions of the data. The study utilised purposive sampling to enhance transferability judgement (See section 4.7). Purposive sampling, according to Creswell (2003:201), yields more detailed results than other sampling techniques, which makes it essential for enhancing the results' transferability.

4.11.3 Dependability

According to Middleton (2019), dependability is the consistency of findings across time. To demonstrate how data is gathered, documented, and analysed, it requires the researcher to account for all study decisions and activities (Aspers & Corte, 2019). In this study, activities including note taking and audio recording were used to account for data collection from participants.

A dependability check was employed in this study to find out if the inquiry had flaws or mistakes in conceptualizing the study, collecting the data, interpreting findings, or reporting results. The inclusion and exclusion criteria where the researcher selected ICT experts

namely: Highly Skilled participants, Middle Managers and Senior Managers (directors) for participation in the study and excluded individuals who did not fall in this category served as a dependability check. In addition, the study clearly outlined the research design and its implementation, indicating what had been planned and what had been executed.

4.11.4 Compatibility

Compatibility is defined as the extent to which the results of an investigation could be compatibility or documented by other researchers (Silverman, 2006). Compatibility is mainly concerned with establishing that data and interpretations of the findings are not fabrications of the inquirer's imagination but derived from the data. Several studies indicate that the compatibility of qualitative study can be attained through audit trials, reflexive journals, and triangulation (Middleton, 2019).

The researcher provided details of the coding of responses as well as providing a rationale for merged codes and explained the meanings of the themes. An audit was performed on the process and results of the inquiry to check if the data and interpretations of the study were supported by the material in the audit trail (see Table 4.5).

4.12 DATA MANAGEMENT

Data management has gotten more complex, necessitating that researchers create a plan before collecting data. Organized qualitative data provides a "road map," allowing the researcher to answer study questions (Lin, 2009:133). The following key components of data management will be addressed: data ownership, data storage, and data sharing.

To begin, the researcher and research participants will own the data for this study. Participants in qualitative research are frequently extremely involved with the data collected, which may give them the impression that they own a portion of the data (Roark, 2020). Data

from qualitative research are typically the outcome of a collaborative effort between the participant and the researcher.

In terms of data storage and record keeping, the researcher ensured that the information was backed up. To that end, the interview recording was transcribed and saved on the researcher's laptop (Cliggett, 2013; Roark, 2020). Only the researcher had access to the laptop, which was secured by a password.

If the purpose of the activity is to advance knowledge and science, the University of Pretoria and the researcher have the right to disseminate the data (D'Ignazio, 2017). The form of data sharing is determined by the data set's ownership, sensitivity, and complexity. As a result, before exchanging data, privacy rules such as POPIA were considered.

4.13 ETHICAL CONSIDERATIONS

It is necessary to adhere to several conventional standards and considerations to ensure ethical accountability in this research. Ethics relates to morality, standards of conduct, and concerns of integrity that research practice is expected to adhere to Marshall and Rossman (2014). Ethical debates in qualitative research include issues related to discipline-specific requirements. However, it is common for the Information Systems Research discipline to adopt guidelines from the social sciences. Common amongst the most regarded ethical concerns are issues relating to maintaining anonymity and confidentiality of research participants, voluntary participation, obtaining informed consent and avoiding deception and promoting honesty and transparency in the collection, analysis, interpretation, and presentation of research findings. Other factors relate to conducting research with vulnerable populations and ensuring their interests are protected. However, this did not apply to this research. Nonetheless, this research needed to comply with all applicable standards for ethical research. The measures taken to achieve this goal are detailed in the following discussions.

4.13.1 Ensuring conversant consent

In getting consent, it served the purpose of fully notifying the potential participants of the necessities and associated risks in the research and the need for the participant to utter voluntary approval to be part of the study. This is a way of guarding a participant's right to consent. Before participating in the research, all the interviewees were informed of their right to withdraw from the interview at no consequence at any stage during data collection (Grinyer, 2019). This information was contained in the Research Information Letter (Appendix C) and was repeated before the interviews commenced. Interviewees were also asked to sign consent forms.

4.13.2 Ensuring no harm comes to the participant

Varkey (2021) discusses the importance of ethical guidelines in research, positing that ethical considerations as important principles to maintain transparency and honesty in research and guarantee the appropriate application of research and valid dependable findings. In addition, Varkey (2021) argues that research ethics guidelines are also designed to protect research participants and stakeholders who may be impacted by the research outputs directly or indirectly. This argument follows the principle that research participants' interests, safety and dignity should not be compromised in the pursuit of knowledge. To protect research participants, it was essential to avoid deception and to keep research participants safe. It was also necessary to obtain informed consent and maintain privacy and confidentiality for research participants. Consequently, a Participant Information Letter explaining the purpose and nature of the research was provided to the Research Ethics Committee, the gatekeepers at the case study site, and to each participant in advance (Appendix C). The Research Information Letter also detailed that participation was voluntary, explaining that there were no consequences for refusing to participate and that the participants were free to withdraw their consent at any stage. This information was also repeated to the participants before the interviews began.

4.13.3 Ensuring confidentiality and anonymity

Participants were assured that the research outcomes will remain private and that only those involved in the study were the only ones subjected to the results. Anonymity was maintained as the participants to part in the research separately and the data collected was not linked to the identity of the participants. Furthermore, the participants of the qualitative research were given pseudonyms: *Participant 1, Participant 2*, etc. This was done to protect the identities of the participants. In addition, identifiable information was removed from all documents and interview transcripts to protect the identities of the participants and the case organisation.

4.13.4 Ensuring that permission was obtained

Before the commencement of the research, ethical clearance, and approval to conduct the research was obtained from the University of Pretoria Faculty of Economic and Management Sciences Research Ethics Committee (see Appendix E). One of the conditions for the ethics approval was the submission of prior written approval from the case organisation granting permission to research the organisation. In addition, prior consent was obtained from the research participants before they participated in the study (see Appendix D). Additionally, acknowledgement of the literature used in this study was given where it was due.

4.13.5 Autonomy

The ethical concept of autonomy, often known as respect for individuals, is a key ethical premise that informs the ethical conduct of a researcher (Guyer, 2003). The idea requires professionals to provide their participants with the freedom to make their own decisions after informing them of the potential costs and advantages of such choices (Varkey, 2021). Following this ethical standard, the researcher told the participants about the advantages of the research before the commencement of the interviews and guaranteed them that there

were no possible hazards in participating in the study. Nonetheless, they had the option of withdrawing from the event at any point.

4.13.6 Beneficence

The idea of beneficence is the researcher's obligation to behave in the participant's best interests and supports several moral principles to protect and defend others' rights, prevent harm, get rid of situations that could lead to it, help those with disabilities, and save those in danger (Varkey, 2021). In this regard, the researcher informed the volunteers that to safeguard them from harm, their identities would be masked using pseudonyms.

4.13.7 Non-malevolence

Non-malevolence is the obligation of a researcher to not harm a patient (Beauchamp & Childress, 2009). This clearly stated idea supports several moral principles, including the prohibitions against killing, causing pain or suffering, incapacitating others, inciting offence, and depriving others of life's necessities (Mularski et al., 2009). The researcher took care to avoid disparaging people based on their colour, ethnicity, health, gender, or position in society.

4.13.8 Justice

The standard definition of justice is the fair, equitable, and right treatment of people (Varkey, 2021). The researcher made sure that the participants were at comfortable and at liberty during the interview. In addition, the researcher made sure that everyone was respected for who they were regardless of their ideas or opinions.

4.14 METHODOLOGICAL LIMITATIONS

Determining when saturation has been reached during data gathering is a challenge for qualitative researchers. This is because there is no established formula for calculating data saturation. It is merely the researcher's opinion (Saunders & Lewis, 2018). As a result, a novice researcher could anticipate having trouble determining saturation during interviews. Second, some interviewees may purposefully leave out important details due to the sensitivity of the issues that may come out during the process. Finally, conducting interviews online is difficult since, in contrast to conventional face-to-face interviews, some emotions and participant presence may be missing.

4.15 CONCLUSION

This chapter provides an overview of the research methodologies and techniques available to researchers, as well as the research methodology used in the conduct of this research. The research approach for this study was chosen based on the evaluated literature and its relevance in the circumstances of the investigation. Methodological decisions were also made in accordance with the research aims. Furthermore, the ethical issues incorporated in the approach preparation were documented to guarantee that the research corresponds to ethical research standards. As the methodological decisions involved were explicitly explained, the information included in this chapter are crucial in guaranteeing the credibility of the conclusions originating from this research. The results of the data gathering are reported in the next chapter.

CHAPTER 5: ANALYSIS AND PRESENTATION OF FINDINGS

5.1 INTRODUCTION

This chapter presents the findings of primary research conducted using the study approach mentioned in the preceding chapter. Furthermore, the chapter analyses and interprets the study findings in relation to the research topics. The talks cover the primary study findings in parallel with the findings from the review of relevant literature from past research.

The major research tool in the study was interviewing. In Chapter 4, the Sampling Section included a full explanation of the target population, sampling technique, and sample size. The first section of this chapter presents descriptions of the coding and analysis procedures used to arrive at the study results.

5.2 DEMOGRAPHIC PROFILE OF PARTICIPANTS

Participants were asked to indicate their role at a large IT company in South Africa and work years of experience at a large IT company in South Africa as indicated figure 5.1 and 5.2.

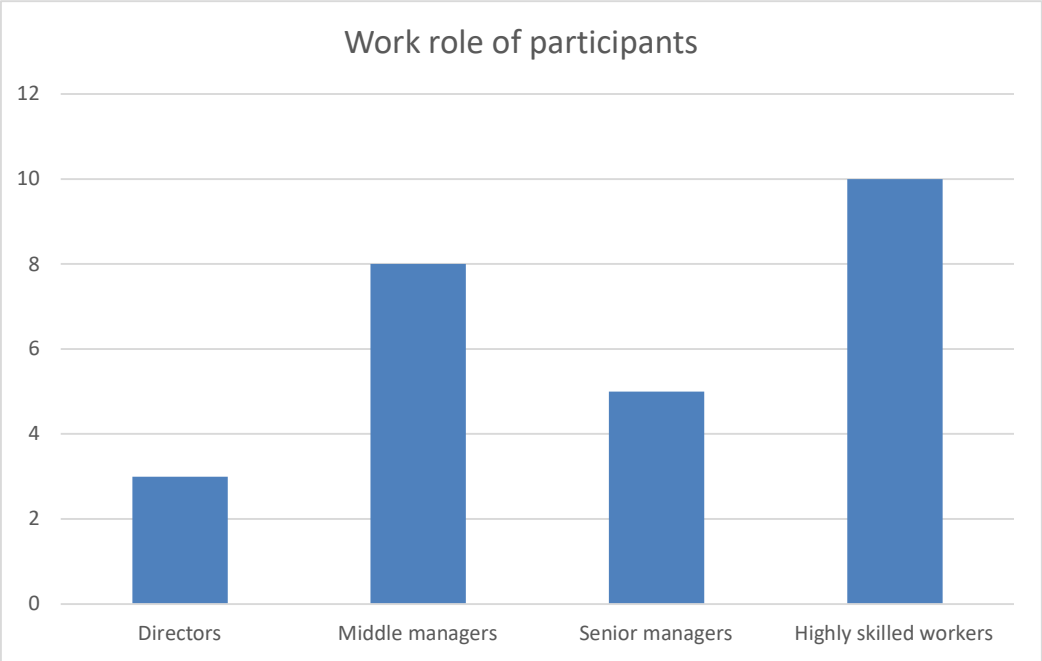


Figure 5.1: Work role of participants

Source: Derived from the primary data

Firstly, the company had (n=5) directors, (n=8) middle managers, (n=5) senior managers and most participants (n=10) were highly skilled employees. The data indicates that the company strategic balance between the number of individuals in management positions and the number of employees, which helps in the implementation of Green ICT.

Figure 5.2 presents the years of experience of participants.

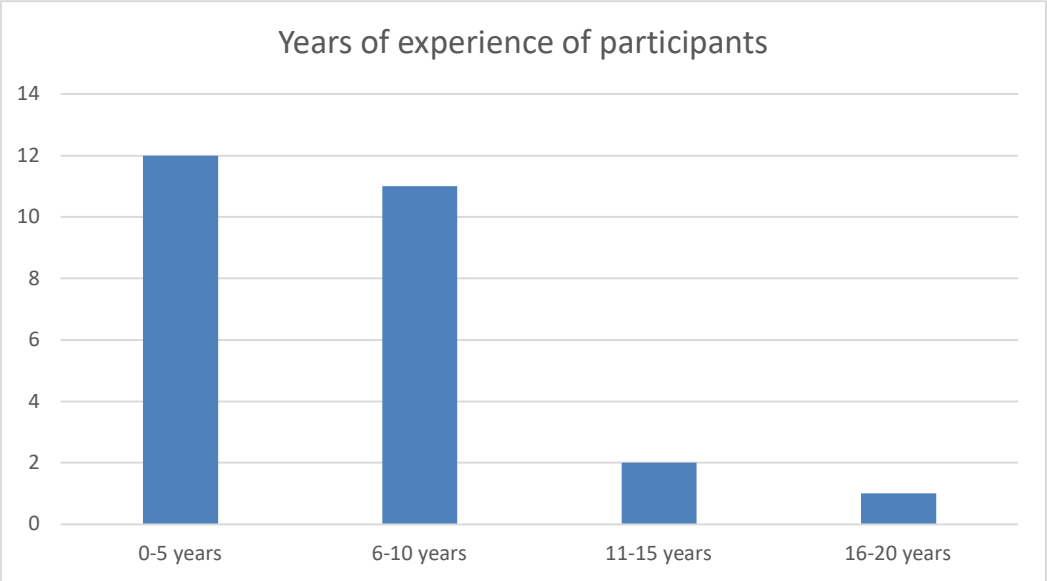


Figure 5.2: Years of experience at a large IT company in South Africa

Source: Derived from the primary data

As indicated in Figure 5.2, the majority of employees at a large IT company in South Africa (n=12) had worked for the company for a period not exceeding 5 years. A considerable number (n=11) had worked for 6 to 10 years at a large IT company in South Africa, while a few (n=2) had been working for the company for a period of between 11 and 15 years. Only one employee had been working for the company for the longest period between 16 and 20 years. The next section presents the qualitative data coding and analysis procedures.

5.3 DESCRIPTIONS OF CODING AND ANALYSIS PROCEDURES

As previously stated, the study's principal research methodology was interviewing. The author recorded and transcribed the participant interviews verbatim, resulting in 26 individual interview transcripts. After that, the transcripts were cleaned, proofread, and saved on a password-protected computer. ATLAS.ti, a Computer-assisted Qualitative Data Analysis

Software (CAQDAS), was used to undertake thematic analysis. According to Braun and Clark (2006), the analysis followed a systematic data reduction procedure in which codes, subcategories, categories, subthemes, and main themes were generated from the source data. The author reviewed and tagged the transcripts independently and discussed concept meaning with the research supervisor. According to Creswell and Poth (2017), the procedure ensured rather steady results where there were interpretation disagreements.

According to Braun and Clark (2006), the analysis followed a systematic data reduction procedure in which codes, subcategories, categories, subthemes, and main themes were generated from the source data. The author reviewed and tagged the transcripts independently and discussed concept meaning with the research supervisor. According to Creswell and Poth (2017), the procedure ensured rather steady results where there were interpretation disagreements. This process yielded six themes.

5.4 PRESENTATION OF THE RESEARCH FINDINGS

The following sections provide, analyse, and analyse the primary research findings derived from the primary data collected. The talks in the following study parts addressed the major research issue and aided in the accomplishment of this research's goal. The subsections that follow investigate the study subjects, challenges addressing the existing methods to Green ICT implementation at a big South African IT firm, drivers of Green ICT implementation, and hurdles to Green ICT implementations. The subsections that follow examine these themes, as well as their component subthemes and categories that were maintained from the raw data that was evaluated. The GITAM model was used as a theoretical lens to understand the implementation of Green ICT through an in-depth analysis of the three pillars of the GITAM model. The Green ICT context, the Green ICT implementation readiness, and Green ICT implementation drivers, and finally the Green ICT overall intention and adoption in a large ICT company in South Africa. The aim was to

understand how resources were used to implement Green ICT at a large IT company in South Africa.

5.4.1 Theme 1: COVID-19 emergency response as a surprising catalyst for Green ICT implementation

This theme comes within the GITAM model's Green ICT context. The study's timeframe provided a unique chance to investigate the effects of a worldwide crisis and the ensuing emergency reaction to COVID-19 on Green ICT deployment. An effort like this might assist shape future practise and create resilience into Green ICT adoption during an emergency reaction. Figure 5.3 depicts the impact of COVID-19 on Green ICT deployment.

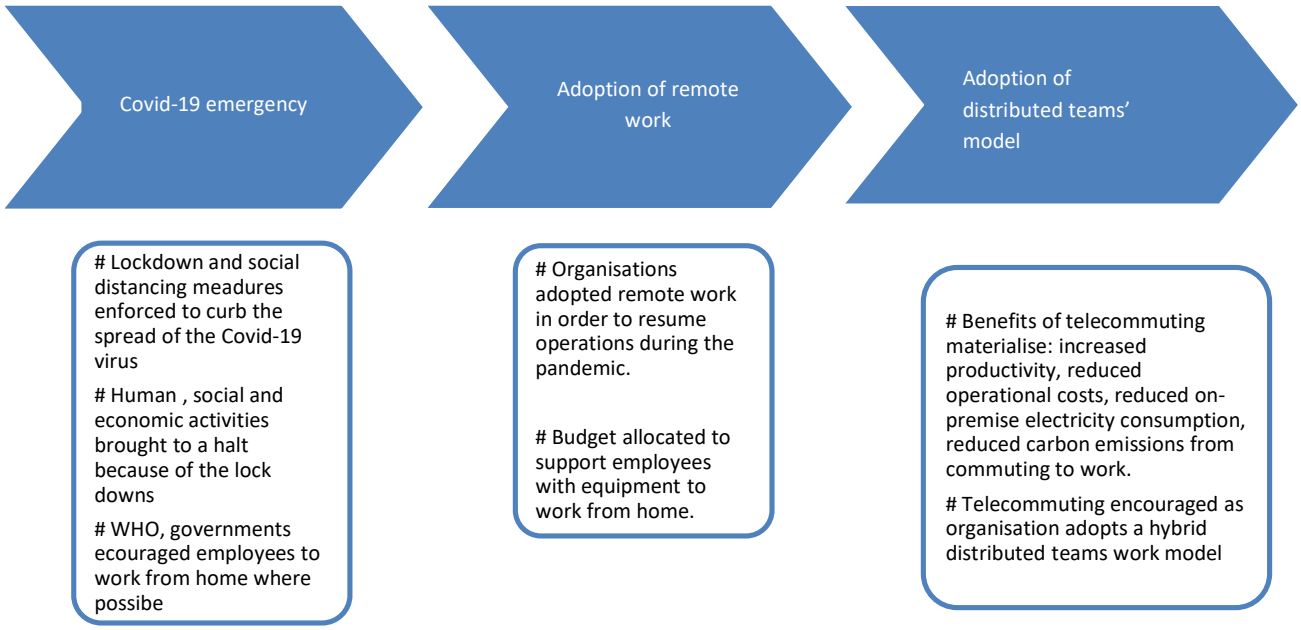


Figure 5.3: COVID-19 emergency response accelerated adoption of telecommuting in the case organisation.

A surprise discovery reveals that the COVID-19 outbreak triggered an emergency response that acted as a catalyst for Green ICT deployment at a significant South African IT firm. As the world implemented measures to prevent the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for the COVID-19 disease, organisations such as a large IT company in South Africa were forced to implement precautionary measures such as social distancing and remote work practises. The subsequent steps required the transition to remote work in specific areas of the economy and employment functions where it was viable. One of the industries where remote employment is possible is ICT. As a result, a large IT company in South Africa also transitioned to remote work at the beginning of the pandemic, with one of the senior executives admitting that *"the pandemic has impacted the way we operate"* (Participant 1). One of the senior managers (Participant 18) made the following comment, which demonstrates the influence COVID-19 had on the organization's operations. The reaction demonstrates how difficult it was for the leadership and employers to maintain operations in the midst of a worldwide disaster:

"We had to work from home when we restarted operations. But it was very difficult. No one can say they were ready for that change because no one anticipated it [the pandemic]. Then because of the lockdown, we could not bring our staff on-site to train them on how to use our systems for working from home … we had to make sure everyone on our team had the proper setup to continue working in terms of laptops, monitors, good internet infrastructure, home office furniture, cybersecurity and so on. So there had to be a budget for that. But we also faced a couple of issues with supply because demand was so high... Then our meetings were now virtual. We also saw widespread adoption of online collaborative tools … to keep the whole team on task with our projects and work." *(Participant 18)*

Telecommuting became the primary mode of operation, with video conferencing and online collaborative work platforms such as "Zoom and Microsoft Teams" becoming widespread. The same participant mentioned some of the advantages of remote

employment, citing cost savings as a significant element for the company. *"… the lockdown forced us to lower operational costs. And I think this was the time when some of the Green ICT practices started to give real tangible benefits that you can see because we could do more even with limited budgets." (Participant 18)*

When the cost savings were obtained, the participants stated that the firm was considering remote work as part of its strategic goals.

Employees who work from home are more likely to be purposeful in terms of practises that minimise power use since they are liable for electricity costs. Working from home may involve practises such as shutting off non-essential equipment and employing power-saving modes, implying that working from home has a beneficial influence on Green ICT adoption. However, one of the managers expressed concern about how difficult it is to oversee staff working from home, particularly when it comes to Green ICT implementation.

"COVID-19 has made it difficult to monitor compliance with our organisational policies we can no longer monitor employees whether they are not completely shutting down their computers or printing when they shouldn't. I can agree with you there that COVID-19 is a challenge for monitoring the implementation of Green ICT." (Participant 17)

This statement demonstrates how the remote work strategy may impede Green ICT adoption since the organisation has limited control over the workers' work practises when working remotely, and the organisation has limited control over the employees' work practises when working remotely *"to rely on the employees themselves to commit to doing the right things"* (Participant 17).

Despite raising concerns, participants discussed the dynamics of remote work and how it affected Green ICT deployment. Participant 6's response encapsulates the strategy as well as the environmental benefits provided by the adoption of the dispersed team model: *"What we have done is that we have now downscaled our premises so that we can have fewer people at the premises ... which means people in future will also not have to travel*

often … We have implemented already 70/30 or 80/20 where 80% of your time will be spent at home working in a distributed team, and 20% might be required for get-togethers when it's safe to do so. So, the focus is to downscale our office footprint, and with that goes anything that you use, electricity, laptops, and phones" (Participant 6)

A significant IT corporation in South Africa might continue operations while working remotely by reducing and simplifying processes for the COVID-19 lockout constraints. The same participant went on to say that after establishing the work from home policy, team members' geographical locations were no longer a burden to their work operations:

"Since COVID-19, we have realised … you can have distributed teams around the world working on a project in the tip of Cape Town, and it doesn't matter where you are. So, you didn't have to get into your car. You just had to fire up your laptop and have descent bandwidth… and connectivity." (Participant 6)

The COVID-19 pandemic appears to have been a critical factor in a large South African IT company making the strategic decision to adopt the distributed team model, allowing the company to enjoy operational benefits such as cost reduction and increased productivity brought about by the ability to work from anywhere in the world. Furthermore, the plan aligns well with the organization's sustainability aims, both in terms of financial and environmental sustainability, as the organisation works to recover from the economic effects of the epidemic. One of the top executives (Participant 10) discussed green recovery and what it meant for the company:

"There is now much more focus on using ICT for sustainable practices. So, it's about how can you use ICT to make the world go greener. And then we are having these conversations about green recovery after the pandemic where the focus is, 'as we open our economies, how can we make sure we do that in an eco-friendly manner?'" (Participant 10)

Another senior executive spoke in on the topic of green recovery. They outlined some of the issues with green recovery in the following statement:

"At some point during the pandemic, we began thinking about when the pandemic is going to end, and… one important conversation has been about green recovery… about going back to the office and getting production levels back to the pre-COVID era, but the focus is about strategies to make that process more environmentally friendly. How do we pollute less? Do we go back to the office 100%, or do we use some hybrid system? Here at a large IT company in South Africa, we are considering a distributed team because it gives us the benefits of working from anywhere whilst still connected, and we have the option of a meeting where it's feasible. So, no' you don't have to travel to the office every day, that way we reduce emissions from the daily commuting. Now Green ICT comes into play by identifying [and] devising efficient and sustainable information and communication technology solutions to facilitate that… and find viable and sustainable solutions to this [global supply chain] crisis, using… data and [and analytics] to develop smart, efficient, and sustainable supply chain networks." (Participant 1)

The statement highlights the favourable environmental implications of green recovery as well as a greater emphasis on employing ICT for sustainable development. The comment also emphasises the supply chain issue caused by the worldwide pandemic, which has added to the difficulties of making the move to remote labour. Supply chain disruption caused a global chip shortage issue, compromising the supply of equipment required for company continuity under remote work situations. The organisation had difficulties owing to supply chain restrictions, with Participant 18 admitting they "had supply issues" (Participant 18). Supply chain bottlenecks were ascribed to the reasons surrounding supply difficulties, as Participant 3 highlighted in detail.

"Covid-19 put a lot of pressure on the global supply chain. Borders were closed. Planes were grounded, ships were not moving, factories were closed and all that. So, there were

delays with getting new equipment. Everything slowed down. And then there was the global chip shortage. It was a crisis" (Participant 3)

The effects of supply chain restrictions and business disruption filtered down into operations, resulting in missed business opportunities and project delays. These considerations had an influence on project delivery as a whole. In addition to the issues stated above, several employees struggled to acclimatise to working from home. Other *"team members did not have reliable internet connections",* while others *"received their equipment late" (Participant 1).*

Despite the problems faced by supply chain restrictions caused by the COVID-19 pandemic, the emergency reaction implemented by a big IT business in South Africa looks to offer considerable long-term benefits for Green ICT adoption. The emergency reaction to the pandemic appears to have hastened the policy to reduce the organization's office footprint and include remote work into the organization's long-term sustainability plan. The pandemic may cause future behaviour changes that benefit the environment.

5.4.2 Theme 2: Green ICT strategies to reduce enterprise-wide carbon footprint

This theme falls under the Green IT readiness. Using the GITAM model, the study sought to establish the Green ICT readiness of a large IT company in South Africa by exploring the strategies they used to reduce enterprise-wide carbon footprint. The following sub-themes emerged:

5.4.2.1 Power management

Energy usage is one of the areas that offers chances to lower enterprise-wide carbon impact. The usage of power management tools is widespread throughout the company, with several participants noting it, including Participant 2, who said:

We are also encouraged to turn off all devices that are not in use. Our systems also have power saving mode which kicks in to save power when devices are not in use. (Participant 2).

A top executive at a prominent South African IT firm highlighted why power management was critical to the organization's operations. They mentioned cost savings as one of the key advantages of energy-saving initiatives:

"The other benefit is realised by lowering the costs associated with utilizing less energy from our computing needs. The cost of energy that we need to run our operations accounts for a major portion of our expenditure, and the benefits of lowering our electricity consumption are substantial." (Participant 1).

Another ICT expert responded to the thoughts that power management was an essential component of the organisation by saying:

"Power management is a huge thing for us. Most of our equipment should have some form of power management features. This reduces electricity wastage and saves us money." (Participant 3).

Another significant component of power management and energy consumption mentioned by Participant 4 is the use of energy-efficient equipment, as stated in the following statement:

"We also aim to reduce our energy consumption with our equipment, so we use high-efficiency equipment and make sure that all non-vital equipment is turned off when not in use." (Participant 4).

5.4.2.2 Paper-reduction

Paper reduction is one of the areas where ICT firms may minimise their enterprise-wide carbon footprint. The firm looks to be making substantial headway towards paper reduction and paperless operations. The participants demonstrated that there was consideration for the environmental impact of printing and paper use, as seen by Participant 10's statement:

"One of the first things that we did was to look at our printing. We consider the impact of the production of paper on the environment. A lot of trees are cut for us to have the paper that we print on, and you only use that document once and throw it in the trash. We said let's limit our use of printing in the office. We don't have printers at every desk, and we print only when necessary." (Participant 10).

The above statement shows issues regarding the impact of removing trees for paper manufacture, as plants absorb a significant amount of carbon dioxide from the atmosphere. Participant 10 also states that lowering the number of printers was one of the measures used to decrease printing. Participant 15 explains how this works in conjunction with a centralised printing system:

"We have a system for printing that we use. We don't have a printer at every desk or every office. Printing is now centralised. There is a single printer for several offices and groups of workers, and we print only when we need to. Printing on both sides of the paper is another measure. By taking these measures, we have reduced the amount of paper we use, and the money we spend on printing is saved." (Participant 15).

Employees appear to be urged to utilise double-sided printing to save paper. Paper recycling is another strategy used by the company to reduce the environmental effect of its printing. Participant 25 claimed in the following statement that they recycle printer paper. Participant 25 stated how the centralised printing system has been beneficial in

limiting "senseless printing" and introducing accountability for papers sent to the printer by employees:

"With paper, if we use paper, we also recycle that, but the main aim with paper is to reduce the amount of printing that we do, so we centralised our printing systems. You no longer just send your documents to the printer whenever you press ctrl p. You go to the printing station. You present your card, and then it prints while you're waiting so that we reduce the possibility of senseless printing of documents." (Participant 25).

Employees are aggressively urged to use digital documents in light of many initiatives in place to limit printing. According to Participant 11, cloud document storage is strongly recommended for employees since it enables for smooth information and document exchange among co-workers.

"We are also sharing electronic documents rather than paper, and instead of printing information, we just store it on our devices and in the cloud." (Participant 11).

Participant 12 discloses an additional benefit of saving information on devices rather than printing in the following statement:

"Instead of printing on paper, we view the documents on tablets and laptops, and we store them there. That creates a lot of room and avoids having dedicated storage space for paper documents." (Participant 12).

By removing the requirement for specific physical document storage and administration, the organisation has instead developed an electronic document management system that also serves as a platform for electronic document distribution and signature. According to a corporate official (Participant 20), this development demonstrates the organisation's dedication to going paperless and contributing to environmental sustainability:

"…But we are also moving on to cloud-based digital document delivery and signing system. I think this shows our commitment to going paperless. And these are some of the small steps we can take to help the environment." (Participant 20)

Whereas Participants 9 and 21 provide insights into the benefits of cloud document management systems, such as the ability to integrate smart contracts and reduce printing costs:

"We now encourage electronic documents. We even have our in-house document management system that we also use to facilitate smart contracts. Signing paperwork is now done online without burning fuel just to ink in a signature." (Participant 9)

and:

"There's been a strong drive within the company to reduce printing. Everyone is now encouraged to use electronic documents, and even for signing documents, it's all done electronically now. We do most of this for the cost-saving benefits." (Participant 21)

The findings are consistent with numerous studies on the benefits of paper reduction as a cost-cutting approach and an environmental sustainability strategy (Jayaprakash & Pillai, 2022; Fernandez et al., 2015). Furthermore, according to the research, electronic document management improves efficiency by making it easier to retrieve data files utilising computerised search capabilities (Jayaprakash & Pillai, 2022). Furthermore, companies generate less waste that must be recycled, burnt, or disposed of in a landfill (Zhang & Liu, 2015). Businesses may save money on supplies such as toner, printer and copier maintenance, paper, power, and shredding services by printing less (Esfahani et al., 2018).

5.4.2.3 Telecommuting

Another Green ICT practise that a prominent IT firm in South Africa Ltd implements is telecommuting or remote work. Employees of the business were observed increasingly

working from home, particularly in light of the ongoing COVID-19 epidemic, using the so-called 'distributed team' concept. As Participant 22 pointed out:

"We have downscaled our premises so that the people do not have to travel often or ever to a particular customer or workplace they can do all of it. We implemented an 80/20 rule where 80% of your time is spent working from home, and 20% might be required in the office. While this was a forced consequence of the pandemic, we are seeing the benefits of not being confined to only one geographical area for work purposes because you can now be more productive wherever you are." (Participant 22).

However, higher productivity and the ability to work from any location are not the sole advantages of telecommuting:

"Working from home helps us in our efforts to reduce our office footprint. With a smaller office footprint, we can save on keeping the office running things like heating, air conditioning and so on. At the same time, it is good for the environment because we now have fewer people contributing to the daily air pollution. With a distributed team, we can even downsize our office in the future. That way, we can even save on rentals." (Participant 22)

This research also reveals a correlation between green recovery and office footprint reduction, implying that both regulations are driving Green ICT deployment. Given this practise, the business provides its staff with the tools and equipment they need to work remotely, such as a sufficient internet connection and PCs. A senior manager (Participant 6) explained how the business was encouraging remote work as part of its attempts to reduce the size of its office footprint:

"We are more and more aligned with our staff to live and work outside our borders or live and work outside of the city centres because distributed teams are now possible, and we have also allowed their allowances. We have given our staff allowances to pay for

connectivity wherever they are. We are funding that so that they are capable and able to deliver services from wherever." (Participant 6).

This evidence demonstrates that governance considerations were taken to promote remote working by allocating the appropriate resources and establishing a budget for the effort. Government incentives are recognised as a crucial driver of Green ICT deployment, according to the GITAM model (Molla, 2008). According to the research, telecommuting is a significant technique to reduce power usage and the need for new computers (Tutusaus et al., 2018). A virtualized workforce also allows for lower operational costs and smaller footprints (Unhelkar, 2016).

5.4.2.4 ICT end-of-life policy guides recycling and reuse

This part of the sub-theme falls under Green ICT readiness on the GITAM model. The ICT end-of-life policy seems to influence the disposal of ICT equipment. The recycling practices appear to be guided by government regulations, industry and customer expectations, and the company's cost-saving and corporate image strategies. The following remark made by Participant 17 relates the recycling practices to comply with government regulations:

"*We recycle our e-waste, and we do this to comply with the regulations on e-waste disposal. If I can be specific, the National Environmental Waste Act regulates these kinds of things relating to the disposal of electronic waste. We have a recycling centre for recycling things like paper, outdated computers and broken-down IT equipment."* (Participant 17).

Regulatory compliance is a common subject in recycling practises, as numerous other participants mention the requirement to dispose of electronic garbage in an environmentally friendly manner. Participant 12 highlights regulatory pressure to guarantee that e-waste disposal does not contaminate the environment:

Regulatory pressure drives initiatives such as e-waste management and recycling. We are obligated by law to dispose of our garbage in an environmentally friendly manner. We can't just destroy our old equipment or do something like that." (12th participant)

Participant 21 adds the cost-saving benefits and the requirement for regulatory compliance in the areas in which they operate:

"We do most of this for the cost-saving benefits and to keep up with government regulations in all the countries we are stationed in." (Participant 21).

Paper and other electronic debris were also submitted to the recycling site by the participants. Damaged or non-functional equipment was identified as being recycled for components to be used in fixing broken-down computers. It is also demonstrated that a significant South African IT firm relies on approved recycling partners to assist with compliance, as stated by Participant 12: "In addition to that, we are doing a lot of recycling. We have a couple of recycling centres, and for the items, we can't recycle ourselves, we work with our the-waste management partners. All our recycling efforts have a strong focus on reducing the output that contributes to pollution." (Participant 12).

Recycling practises appear to be deeply established throughout the firm, motivated by regulatory compliance, corporate image, cost-cutting, and a desire to reduce environmental damage. Company policies and end-of-life guidelines for ICT equipment advise electronic waste disposal in accordance with government requirements. The findings are consistent with the research, which suggests that waste management regulations in South Africa have resulted in a beneficial outcome, with less e-waste ending up in landfills (Lawhon, 2013). Legislative recycling procedures must be properly implemented in order to have the least harmful impact on the environment and human health (Bekaroo et al., 2016). The GITAM model emphasises that if the ethical motivations of Green IT give motivation for organisations to deploy Green ICT in order to fit with societal values and expectations.

5.4.3 Theme 3: Reducing enterprise-wide carbon footprint through Green ICT procurement and sourcing practices

This theme falls under the GITAM model's Green ICT preparedness. Data suggests that firm policies affect Green ICT related practises, since participants claim that Green ICT is "embedded" in their policies (Participant 20):

"… when we look at vendors we work with, the systems we choose to apply, the software we utilise, and the processes end to end in that structure, it is underpinned by Green ICT from a sustainability perspective. The main strategy is to save money... While we are saving money, we are thinking of the best way to deliver things with the least resources, whether that's people, time, energy, everything" (Participant 20).

According to the research, significant ICT companies in South Africa prioritise ecologically preferable ICT purchase from a sourcing standpoint. This includes implementing sourcing and procurement practises such as measuring the environmental impact of the ICT supply chain, evaluating hardware, and including green problems such as recyclable design and packaging into vendor assessment and ICT buying choices (Molla et al., 2009). However, the preceding sentence also emphasises the necessity of saving money, implying that energy savings concerns are also entrenched in procurement strategy. Participant 9 indicated that it was mandatory for *"vendors and business partners"* to provide equipment and *"gear that satisfies"* their required *"energy-saving standards."* This claim was supported by Participant 12, who affirmed how the sourcing and procurement policy guides the procurement process.

"We have policies within a large ICT company in South Africa that dictate the kind of computers that we can use. There are specific energy usage and operational parameters that we need to use. All the ICT equipment we use must meet specific energy ratings that allow us to reduce our energy use." (Participant 12).

This result demonstrates that the procurement practises employed at a significant South African IT company are impacted by the organisation's sourcing and procurement policy. Participant 12 went on to describe some of their purchase needs, citing the Energy Star Initiative:

"As an organisation, we have certain standards or criteria for the type of equipment we use. The equipment we buy must meet certain energy efficiency… specifications. The Energy Star initiative is now an international standard for electronic equipment that provides ratings on how much energy equipment is used. You can notice that all our computers have Energy Star stickers that assure us that the equipment we use is environmentally friendly." (Participant 12).

Participant 16 also indicated the energy efficiency criteria for new equipment, emphasising that efficient equipment leads to energy savings, a significant issue for cost reduction:

"We established rules that restrict the types of computers we may use, along with specified energy consumption and operational specifications. All the IT equipment we use must fulfil particular energy ratings for us to save energy. So, our computers, for example, have Energy Star stickers to indicate the rated energy usage and efficiency." (Participant 16).

From these findings, it can be concluded that the sourcing and procurement policy guides the procurement process for buying new equipment. The procurement process emphasises environmentally preferable ICT purchasing. The influence of sourcing and procurement policy cascades down to initiatives to reduce enterprise-wide carbon footprint.

The findings concur with the findings of Hendandez (2020b), who discovered that green ICT procurement helps guarantee that environmental concerns are integrated into buying policies, plans, and activities. Furthermore, green shopping encourages recycling, reuse, and resource conservation. There are no industry standards for green procurement (Mcobrein & Ackah, 2019). Green procurement also ensures that purchases give

exceptional value for money by considering the whole life cycle and resulting in social and economic advantages for both the organisation and the environment (Singh & Chan, 2022).

5.4.4 Theme 4: Embracing Green ICT practices for business sustainability

This theme is understood to be in the context of Green ICT drivers. The subject arose from the desire to contextualise attitudes towards environmental sustainability. General questions on the significance of the Green ICT concept and how it is perceived inside the company were sought. According to the findings, there appear to be competing demands between commercial sustainability and environmental sustainability. The analysis discovered indications that the organisation prioritised environmental sustainability. For example, the concept of Green ICT is generally understood to be related to the concept of *"sustainability in ICT operations"* (Participant 22). This conceptualisation shows Green ICT is seen as a means first to minimise the negative impact of ICT on the environment and, secondly, to increase the positive impact of ICT on the environment. Ultimately, Green ICT is viewed as an enabler for green initiatives in other sectors of the economy, as illustrated by the following response from Participant 18:

"When it comes to lowering the environmental impact of IT, you… consider how products are manufactured… used, as well as how they are disposed of after usage. You aim to minimize environmental impact by recycling and reusing obsolete equipment, conserving energy, and considering sustainable procurement. The second aspect is about using ICT to minimise the effects of global warming and reduce climate change by supporting sustainable initiatives in other industries like sustainable mobility, green logistics and things like that. These are areas where you can use tools and techniques from information systems to drive sustainable projects, collecting and reporting ecological data, using analytics and machine learning to improve other fields, so they become cleaner" (Participant 18)

The researcher also investigated the significance of Green ICT and how it linked to the overall strategy of the firm. Climate change worries were expressed by participants, indicating that *"Green ICT is very important in the help to (sic) fight against climate change and global warming."* Participant 14 appeared passionate on the matter of environmental sustainability, showing regard for future generations and concern for the environmental impact of technology use:

"Green ICT is… a commitment to make sure that everyone who uses technology is aware not only of the benefits, but the impacts on the environment and climate change, and… what must be done to use technology with environmental sustainability in mind. We do not have to be selfish on this issue of climate change. We must keep future generations in mind. Will they benefit from what we are doing now, or are we putting them on a back foot? … You must think, what if I just do the right thing now. I think that if we prioritise Green ICT, we can use our state-of-the-art information systems to track environmental parameters and preserve data that future generations can … use" (Participant 14)

A participant in the organisation's senior management (Participant 15) confirms that environmental sustainability is one of the organization's goals in the following statement: *"As part of our governance structure, we have sustainability themes, about six of them, and the last theme is about acting on climate change. Going green is part of our priority goal, and we are highly aware of the strong social consciousness to prevent climate change and the technology we use and offer to customers offer innovative solutions to create an environment that is more secure, healthier, and efficient."*

Using the concept of social awareness, one may link to the concept of corporate social responsibility and how the business is motivated by ethical concerns to evaluate the impact of its operations on society and the environment. Participant 7 offered the following comment in support of the view that ethics and social consciousness are integrated inside the organisation:

"With our core business being technology, our core focus is on society, so we must look at the impact of our work on society. For example, we take it seriously doing ethical business with our clients that are developing technologies technology Solutions that are ethical."

Participant 5 made a statement in this respect, emphasising how corporate social responsibility is linked to organisational strategy:

"The overall organisational strategy also encompasses corporate social responsibility, and I believe that Green ICT ties into that perfectly well because we have to be a responsible organisation taking care of our environment as well as the society."

Other IT professionals and organisational executives demonstrated a good approach towards social responsibility as well. One member stated, "Ensuring that our IT operations do not have any negative effects is part of our obligation to corporate responsibility*." We must do all in our power to preserve the environment"* (Participant 11). The personnel of the large ICT firm in South Africa are motivated to do the right thing since the corporation has a favourable attitude towards social responsibility. Participants also talked about "conscious capitalism," with Participant 11 saying that it "should go hand in hand with a serious level of consciousness about our environmental impact so that the impact of our work serves society for good on all fronts" (Participant 11).

These comments indicate a good company attitude towards environmental issues and the use of Green ICT. However, it appears that environmental sustainability may not be the primary motivator of Green ICT implementation. Rather, lowering operating expenses appears to be the primary motivator for Green ICT deployment. This is demonstrated by several remarks made by participants. When asked how Green ICT connects to the organization's overall strategies, one of the senior managers (Participant 6) responded as follows:

"So, the overall strategies save money… Before being sustainable, it saves money. We are in a big cost-saving mode because of where the world is now. Our job is also to save money and costs for our clients… So, it is extremely strategically related. So, while you are saving money, you are thinking of the best way to deliver… [with] the least number of resources, whether that's people, time, energy, everything."

The comment above explains how Green ICT deployment fits within the organization's cost-cutting plan by achieving results with the fewest resources. It also implies a preference for commercial sustainability above environmental sustainability. The comment is supported by Participant 15, who mentioned the relevance of Green ICT in guaranteeing business sustainability by boosting value proposition and benefiting the organization's bottom line:

"All the practices for green IT that we adopt [come] as part of our larger strategy towards building a sustainable organisation. We are aligning our IT to better achieve our objective [while] at the same time managing risk and meeting requirements for regulatory compliance that's part of the GRC framework. Adopting Green ICT enhances our value proposition to clients who also have environmental concerns. We can retain more of them and improve our sales volumes. The green initiatives we embark on directly relate to our bottom line. The more we recycle and reuse, the more we can save."

This demonstrates the importance of Green ICT adoption in improving the organization's value offering. Participant 20 demonstrates a high focus on compliance and the economic benefits of increasing the organization's value offer in the following statement:

"So, everything is tied into our larger strategy towards building a sustainable organisation by making sure we meet the requirements for our Governance, Risk and Compliance framework. It is not only about compliance, but then it also relates to our value proposition to our valued clients and stakeholders. They will see us as both responsible and compliant because of our efforts to address environmental concerns. Our business will benefit from higher retention rates because of this."

Furthermore, data shows that Green ICT deployment matches with the organization's cost-cutting plan because these practises enable for the delivery of outputs with the fewest resources. Green ICT appears to be viewed as both a reaction to the need to improve the value offer and one of the answers to lowering operating expenses. This outcome indicates that the organisation takes a reactive approach to Green ICT deployment rather than prioritising environmental issues. Participant 20 emphasised the absence of environmental sustainability in the organization's vision and goal statements, indicating a lack of prioritisation:

"I would say sustainability is an important component of our organisation that guides our sustainability practices. But it's not part of our vision and mission statement. You see, it's not formalised in that sense."

These findings highlight the competing agendas of corporate and environmental sustainability. Nonetheless, it is heartening that a significant South African ICT corporation, as indicated in the next section, includes Green ICT practises that contribute to favourable environmental consequences.

The findings reveal that a significant South African ICT business wanted to include environmental sustainability into its operations. The GITAM paradigm, which emphasises the significance of context in aiding Green IT deployment (Molla, 2008), best explains this mindset. To that end, the organisational context is responsible for enforcing environmental standards that promote Green ICT, and at the organisational level, they establish norms for workers to comply. Hankel et al. (2018) agree with Fernando et al. (2018) that Green ICT should be considered as a potential solution to accomplish long-term results rather than a cause of environmental problems. They go on to say that such a viewpoint necessitates a new approach to operations with the goal of producing good results and enhancing an organization's economic and environmental development. Such a business mindset dispels the myth of an economic-ecological conflict, demonstrating that Green ICT should be

leveraged to provide beneficial economic, social, and environmental outcomes (Hankel et al., 2018; Fernando et al., 2018).

5.4.5 Theme 5: Green ICT policy

This subject focuses on the GITAM model's Green ICT drivers. This subject reports on the extent to which green policies are established and implemented across the whole value chain of the firm. The insights provided by this subject aid in determining if a big South African ICT firm has a defined Green ICT policy.

There does not appear to be a clearly defined Green ICT policy that describes the roles, duties, and processes for Green ICT implementation, implying that the organisation takes a reactive approach to Green ICT. For example, Participant 4 made the following remark:

"People just talk about the bigger picture of Green ICT, but if we look, for example, in our organisation, there is no framework on how to implement it."

The same participant went on to add a disclaimer, stating:

"But I should say that we have Green ICT practices that we implement in our day-to-day work."

Participant testimony on many accounts reveals a significant lack of a clearly defined common policy for Green ICT deployment. One of the participants (Participant 7) responded as follows:

"I cannot say that we have a specific strategy per se, but we have adopted a few practices to ensure that our work has a reduced impact on the environment."

Another participant (Participant 20) also lamented that the policy is not formalised:

"I would say sustainability is an important component of our organisation that guides our sustainability practices. But it's not part of our vision and mission statement. You see, it's not formalised in that sense."

Refer to Participant 2's comment, which referenced to general expectations and industry norms, for insights into the drivers driving Green ICT practises in the organisation:

"Then it is the general expectation that businesses minimise the impact of their operations on the environment. The whole industry is pushing for green computing, and we also must go in that direction."

Later in the interview, the same Participant made another admission, this time referring to government restrictions, namely those governing electronic trash disposal:

"Honesty it's external pressure from regulations and industry standards. We have to comply with government regulations, so we recycle our electronic waste."

Other participants, including Participants 3 and 4, made remarks reinforcing the view that the reactive approach to deploy Green ICT is motivated by external pressure as well as cost reduction, as seen in the two quotations below:

"Green ICT saves money. Thus, we find ourselves in a scenario where we need to reduce our expenditure and become more lucrative, and introducing Green ICT comes up as a solution. We also face pressure from the government and customers. On the one hand, the government has regulations requiring us to green our operations." (Participant 3)

Participant 3 added:

"Because of the level of awareness of environmental issues, there also comes regulations, for example, on responsible disposal of e-waste. We must comply with those regulations." (Participant 4)

The findings indicate that, in addition to lacking a clear formal strategy or policy framework for Green ICT implementation, the organisation takes a reactive approach to Green ICT. As a result, an apparently haphazard collection of tactics is employed. According to the research, the lack of a clearly defined uniform framework for implementation is a barrier to effective implementation (Molla et al., 2009). Despite the lack of a clearly defined Green ICT policy, the findings demonstrated that general business policies at a big South African ICT company significantly affect Green ICT implementation by directing the practises and technology that enable implementation.

5.4.6 Theme 6: Implementing Green ICT for business sustainability

On the GITAM model, this subject addresses Green ICT intention and adoption as well as Green ICT readiness. The parts that follow draw on study findings to show how deploying Green ICT adds to measurable and good results for the organisation. According to the data, Green ICT implementation is mostly focused on one of two outcomes: cost savings or compliance with government rules or consumer and industry expectations. One of the senior managers (Participant 17) stated how cost reduction and customer expectations are major drivers for Green ICT:

“Green ICT lessens unnecessary expenses by adopting hardware or software solutions that save energy or reduce energy loss. You can see that it shows a good consumer image because of how important going green and preventing climate change has become for consumers.” (Participant 17).

The same participant went on to explain why these results are critical for the future commercial viability of a significant ICT company in South Africa:

"I have mentioned how Green ICT saves money, so we get into a situation where we say we need to cut our spending and be more profitable. Implementing Green ICT comes up as a solution. We also get pressure from the government and consumers. On the one hand,

the government has legislation that pushes us to green our operations. On the other hand, consumers and investors are more conscious of matters of climate change and global warming and pollution. So, we have to comply with the government's requirements; otherwise, we'll be shut down, and if we don't go green, we will lose our customers. Going green is an effective marketing strategy that attracts customers and investors and grows the business's revenues." (Participant 17).

The accompanying quote from Participant 17 demonstrates how important Green ICT is for corporate sustainability objectives. These results assist the company in saving money and improving its value proposition without losing business due to noncompliance with legislation or inability to fulfil customer expectations. The sections that follow are given as sub-themes that demonstrate how a significant South African ICT firm implemented Green ICT. The topic also emphasises the good environmental implications of these practises. The sub-themes range from procurement and sourcing processes to energy consumption and power management, telecommuting/remote work, paper reduction, recycling, and technology usage and development. 5.4 highlights the major practices employed at a large South African ICT organisation.

Figure 5.4: Implementation of Green ICT at a large ICT company in South Africa

In accordance with the GITAM model's organisational framework, a big South African ICT firm analyses the environmental footprint, recyclable design and packaging, and proactively conducts vendor assessments based on environmental factors. Desktop power management systems have been described in the literature as a simple and efficient technique to save money and minimise emissions Ziemba (2019a). This study backs up Ziemba's claims, with participants agreeing that the implementation of power management systems is primarily motivated by cost savings and the avoidance of energy waste. The usage of power management systems is also related to the use and development of technology. Previous study found that an organization's technical skills influence its capacity to successfully integrate Green ICT (Fernandez et al., 2015; Lundfall et al., 2015; Klimova, 2018).

Green ICT technology was identified as reflecting how firms acquire and construct a more ecologically effective ICT infrastructure. This includes technologies and information systems

for lowering the energy consumption of powering and cooling ICT assets, optimising the energy efficiency of ICT technical infrastructure, lowering ICT-induced greenhouse gas emissions, replacing carbon-emitting business practises, and calculating a company's total environmental footprint (Irfan & Putra, 2020). Green ICT technology readiness, according to Molla et al. (2009), may be determined by examining the extent to which a company has a green business infrastructure. These findings show that the organization's practises are consistent with the research on Green ICT adoption and implementation (Jayaprakash & Pillai, 2022).

5.5 CONCLUSION

In this chapter, we presented, interpreted, and discussed the research findings derived from collecting primary qualitative data. These findings highlighted several themes that addressed the main research question and the purpose of the study. The analysis of the data revealed six main themes: 'COVID-19 emergency response: an unexpected driver for Green ICT implementation', 'Approaches to decrease the carbon footprint across the organization', 'Ambiguous Green ICT policy', 'Adopting Green ICT practices for sustainable business', 'Green ICT policy', and 'Business perspective on sustainability'.

The main focus of the discussion revolved around the implementation of Green ICT practices for business sustainability. This topic was further divided into seven subthemes, out of which four were discussed in detail. These subthemes included reducing the carbon footprint through green ICT procurement and sourcing, power management, and telecommuting. The findings of the study addressed the objectives by examining current approaches, drivers, readiness, and context of Green ICT implementation. The next chapter will conclude the empirical study by presenting the findings, implications for practice and management, and recommendations for future research.

CHAPTER 6: INTERPRETIVE FRAMEWORK FOR GREEN ICT

6.1 INTRODUCTION

The purpose of this chapter is to propose an interpretive framework for Green IT. The proposed framework is associated with the major themes associated with seminal works on GITAM, that was enhanced through a qualitative investigation of participants' experiences during a Green IT implementation. A framework was important in this study in that it helped in structuring the empirical inquiry as well as theoretical development in Green IT research and practice. The framework was informed by the theories discussed in chapter 3, findings from the secondary literature as well as findings from the empirical study.

6.2 THE INTERPRETIVE FRAMEWORK FOR GREEN ICT

The proposed framework for Green ICT expands the models discussed in chapter 3 namely, responsible information systems, theory of reasoned action, norm activation theory, GITAM model, the G-readiness framework and personnel preparedness theory. Based on the literature and findings from the primary study, Green ICT is driven by governance, social and cultural factors, information technology and top management support. As indicated in figure 6.1, the framework has four Green ICT constructs namely: Green ICT management, Green ICT governance, information technology and social factors.

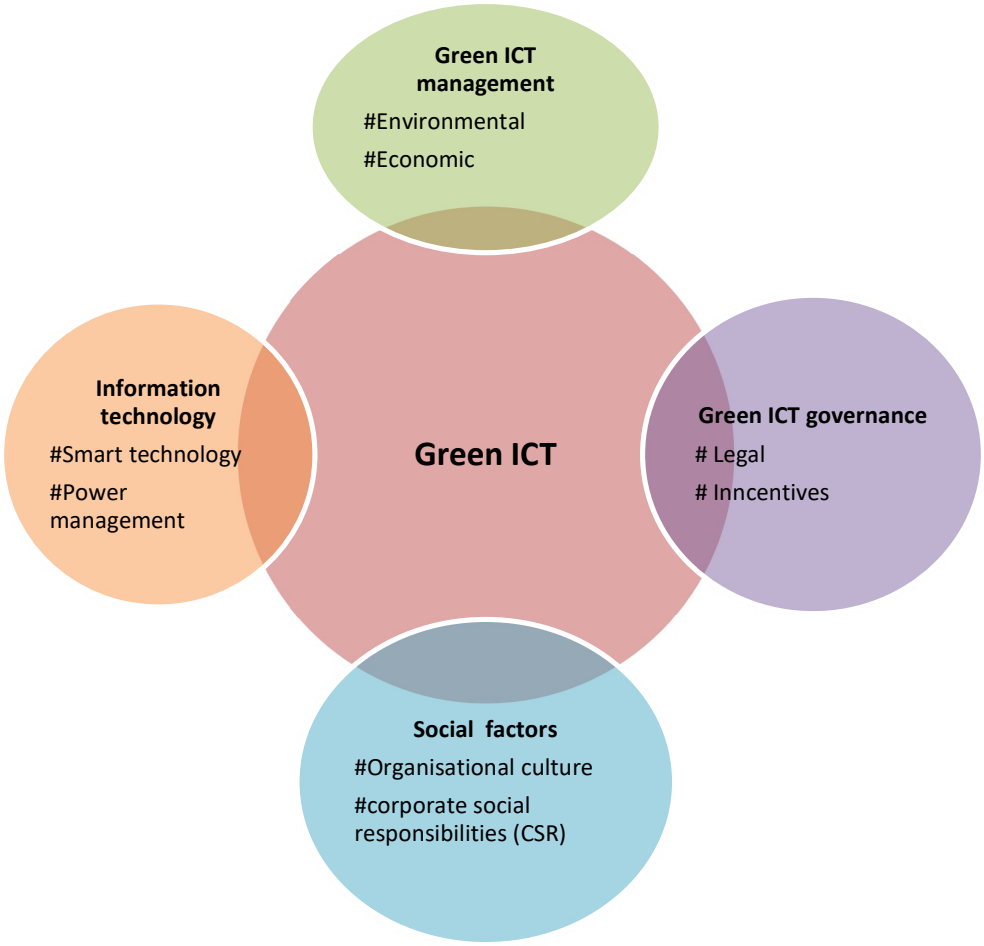


Figure 6.1: Interpretive framework for Green ICT

Source: Constructs were derived from previous models (Ajzen, 1991; Molla & Cooper, 2009; Tornatzky, Fleischer & Chakrabarti,1990).

6.2.1 Green ICT governance

The findings of the empirical study also highlighted the importance of regulation such as the COVID-19 regulations which pushed companies to adopt Green ICT mechanisms such as telecommuting. However, the findings indicate that there is a lack of clearly defined Green ICT policy. In light of the above findings, the Green ICT governance construct highlights that Green ICT regulations should ensure compliance with Green ICT policies. Under this construct, the researcher included regulatory pressures and incentives. The findings of the literature review revealed that regulatory pressures and incentives were key determinants of Green ICT implementation. This can be done using methods such as certification (Bohas & Poussing, 2016; Alsultanny & Alnassar, 2017) and stiff penalties for non-compliance (Unhelkar, 2016).

6.2.2 Social factors

The findings from the literature review revealed that organisations that implement Green ICT employ activities such waste reduction and increased energy efficiency (Marx & Van Dyk, 2011). In addition, the findings from primary study showed that the case organisation had a sustainability culture which supported Green ICT adoption. However, it was not mentioned as part of the Green ICT implementation strategies at a large ICT company in South Africa yet is provides benefits to both the organisation and the society. To that end, the framework added corporate social responsibilities (CSR) as it ensures that Green ICT compliant companies are visible and through these CSR initiatives, they spread Green ICT awareness among employees and customers. The firm's self-regulation is referred to as CSR. It demands that businesses hold themselves, their stakeholders, and the broader public accountable (Qin Xiliang et. al, 2023).

6.2.3 Information Technology

The findings from the literature review revealed that South Africa is currently witnessing a quantum leap in the digital transformation. Therefore, to address the potential negative effects of digital technologies on the environmental, most companies are utilising sever virtualisation which allows for one or more "virtual" servers on a single physical host system (Anthony, 2016). In addition, power management solutions are beneficial to both the organisation and the environment as they reduce carbon emissions and provide a quick return on investment for businesses (Ziemba, 2019b). Telecommuting has also emerged as an effective way to cut down on the consumption of electricity (Tutusaus et al., 2018). The literature review findings also revealed that the use of electronic document help to reduce carbon footprint while increasing efficiency by making it simpler to find data files using computerised search capabilities (Jayaprakash & Pillai, 2022). The findings from the primary study highlighted that A large IT company in South Africa was utilising telecommuting and paper reduction.

In light of the findings, the information technology construct addresses aspects of digital technology development and their influence on the organisation. The concept also emphasises digital technology innovation and its impact on productivity and sustainability. As a result, the information technology theme will consider all preceding aspects by including the technological features namely, the use of smart technology and power management. Smart technology encompasses any technologies that incorporate end-user computing, such as smartphones, tablets, and wearable gadgets. The technology construct indicates that investment in smart technology can be used as an assessment tool for Green ICT readiness. In addition, implementing desktop power management systems help to save money and minimise emissions.

6.2.4 Green ICT management

The findings from the literature review and primary study both implementing Green ICT was driven by environmental and economic benefits. Actions such as the use of power management tools and paper reduction was prevalent within the organisation, which help to reduce the carbon footprint while reducing operational costs. In addition, the organisation

utilised of telecommuting, adopting distributed teams. While telecommuting is helps to reduction of greenhouse gases related to travel, it also reduces travelling expenses.

The interactive framework builds on the findings of the literature review and primary study to proposing the incorporation of ecological economics and economic systems with activities, systems, and environmental factors into a long-term strategic view. This promotes environmental sustainability, stability, and ecological balance, as well as the maintenance of critical resource components, systems, and variety (Fernandez et al. 2018).

Green ICT environmental management focuses on ways in which organisations manage ICT gadgets and e-waste. Based on the findings from the study, strategies such as paper reduction and the recycling of paper and other electronic waste helped to indicate the organisation's readiness for Green ICT implementation. Using the research findings as a point of departure, the environmental construct empathises the role of managers in ensuring Green ICT implementation by the organisation. As leaders, they are in a strategic position to influence sustainability culture through activities such as workshops, seminars, and green procurement.

6.3 CONCLUSION

The chapter proposed an interactive framework for Green ICT developing the existing theories, environment-organisation framework (TOE) framework, theory of reasoned action (TRA), and theory of planned behaviour (TPB), GITAM model and the G-readiness framework. The model has three constructs, Green ICT governance, social factors, Green information technology, and Green management. The discussions under these constructs were informed by the findings from the secondary literature and empirical study. The next chapter presents the conclusions and recommendations, which is the last chapter of the study.

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The previous chapter presented the interactive framework for Green ICT implementation. The aim of this chapter is to present the conclusions and recommendations related to the study's findings. The findings from the primary study and literature review were utilised to propose an interactive framework for Green ICT (see chapter 5). In this chapter, the recommendations support the guidelines provided by the interactive framework.

The chapter open by presenting an overview of the research problem and research questions. Further, the chapter presents and overview of the research methodology that was utilised in this study. The conclusions from the primary study are presented. The conclusions presented in the chapter relate to the current approaches used in the implementation of Green ICT, the drivers of the adoption of Green ICT within a large IT company in South Africa, South Africa, and the barricades to the implementation of Green ICT within a large IT company in South Africa, South Africa. The theoretical, policy and academic contributions of the study are presented. In addition, the limitations of the study are explained. Finally, the study provides a note on areas which future research can focus on.

7.2 THE PROBLEM STATEMENT AND RESEARCH QUESTIONS

The ICT tools and infrastructure have major contributors to environmental pollution. As a result, there is a global call to address environmental pollution in organisations through Green ICT implementation (Molla et al., 2011; Pan and Zhang, 2020; Mustafa & Abbas, 2021). However, the lack of knowledge and guidelines for Green ICT implementation threated to delay the agenda for sustainable ICT. Most of the previous studies on Green ICT

have emphasised promoted consciousness of environmental sustainability and the urgency for large companies in the field to 'green it,' with several frameworks or guidelines facilitating Green ICT implementation into existing business models. However, much of the focus has been on developed countries and some countries in Asia and the Middle east, while developing countries have been under-represented. In light of this research gap, this study sought to explore Green ICT implementation in a large ICT professional services company in South Africa, Gauteng and propose an interactive framework for Green ICT implementation. The study was guided by the following questions:

i. What are the current approaches used in the implementation of Green ICT?
ii. What are the drivers of the implementation of Green ICT within a large IT company in South Africa, South Africa?
iii. What are the barriers to the implementation of Green ICT within a large IT company in South Africa, South Africa?

7.3 REFLECTIONS ON THE RESEARCH METHODOLOGY

The reasoning for the methodological decisions involved in selecting the research methodology and design, identifying the population and sample, data collecting and analysis techniques, and ethical issues for the study is described in Chapter 4. The research was guided by the interpretivist philosophy to interpret and understand the lived experiences of ICT professional at al large ICT company in Green ICT implementation. The study employed a qualitative research approach as it was appropriate to understand the experiences of ICT professional with implementation of Green ICT at a large ICT company (Baek & Park, 2015). To complement the qualitative approach, the study employed a case study design, thus a large ICT professional services company based in Gauteng was selected as the case organisation. Utilising a case study design helped the researcher to have an in-depth and precise knowledge of Green ICT implementation at the large ICT professional services company.

The study population were 140 people who were employed in operational, administrative, and management jobs at a large IT organisation in South Africa. For participant selection, the researcher deployed purposive sampling select 26 participants for the study. The participants met the inclusion criteria which included: extensive knowledge of the organisation's ICT operations, sustainable practises, and participation in decision-making processes. Semi-structured interviews were utilised for data collection. In designing the interview guide, the researcher utilised the GITAM model. The open-ended questions ensured that participants submitted extensive responses, allowing for the collection of richer and more in-depth data to study participant thoughts, sentiments, behaviours, actions, and attitudes towards Green ICT adoption at the firm.

To ensure that the study followed the criteria and guidelines for ethical research, ethical issues were considered during the collection, processing, analysis, and reporting of data and research findings. Therefore, the researcher embarked on data collection only after receiving ethical approval from the University of Pretoria's Research Ethics Committee. The management of the case organisation provided written permission for the researcher to undertake the study. This permission allowed the researcher to engage the organisation’s employees for the interviews. Participants were given Participant Information forms that detailed the study's goals and objectives, as well as their rights as research participants, which included the possibility to withdraw consent to participate in the study. The interviews were sound recorded with the participants' permission and in accordance with the research protocol. The data was transcribed and stored in a secure password-protected computer to ensure confidentiality. To ensure confidentiality and anonymity, the participants’ real names were replaced by pseudonyms. Therefore, codes Participant 1 to Participant 26 were used. Finally, thematic analysis was used to analyse the primary data. Chapter 5 gave thorough details of the coding and thematic analysis process.

7.4 CONCLUSIONS FROM THE EMPIRICAL STUDY

The major findings of the investigation are provided in Chapter 5 of this dissertation. The primary findings were provided in the form of themes that evolved from the study findings. The conclusions drawn from the research are presented in this section. These findings aid in determining whether or not the research questions were answered and the study's addition to knowledge.

7.4.1 Conclusions for research question 1:

What are the current approaches used in the implementation of Green ICT?

Three main conclusions were made on this research question namely practices reducing enterprise-wide-carbon footprint, business attitude towards sustainability and embracing Green ICT for business sustainability.

7.4.1.1 Practices to reduce enterprise-wide carbon footprint

The findings relating to practises to minimise enterprise-wide carbon footprint showed four sub-themes: power management, paper reduction, telecommuting, and procurement and sourcing. Power management was viewed as a low-cost technique for lowering energy use. Paper reduction was proposed as a method of lowering the environmental effect of printing paper. In addition, paper-reduction helped the organisation to reduce the costs of purchasing paper and printing. The large IT company in South Africa prioritised environmentally preferable IT purchasing from a sourcing perspective. This means that the company gave preferential treatment to companies within its supply chain that were compliant with environmental sustainability policies.

7.4.1.2 Business attitude towards sustainability

According to the GITAM model, it was critical for the study to contextualise attitudes and feelings about environmental sustainability. This subject discussed the participants' feelings on climate change and the role of business in environmental sustainability. The survey discovered apparent opposing goals between corporate and environmental sustainability, reflecting conflicted emotions about sustainability. The organization's experts and leaders seem to understand the importance of environmental sustainability and are committed to addressing climate change and corporate responsibility in reducing the negative impact of ICT on the environment. They view Green ICT as a catalyst for promoting sustainability in other sectors of the economy. These views support the earlier claim that Green ICT serves as a facilitator for green initiatives, as demonstrated in the IT-for-green approach. IT-for-green refers to the use of environmentally friendly IT applications that enhance the environmental performance of other sectors by improving energy efficiency and reducing carbon emissions (Esfahani et al., 2018).

The general attitude towards Green ICT among IT experts and business executives at a big South African IT company was favourable towards environmental problems such as climate change and sustainable business operations. As a result, attitude is a primary driver of Green ICT adoption, as professionals and leadership at a large IT company in South Africa envisage a business that embraces objectives of sustainable business development. Some participants, however, stress commercial sustainability over environmental sustainability. According to the findings, the primary motivator for implementing Green ICT inside the firm was a desire for cost-effectiveness. Some participants stated that ideas for Green ICT must first examine cost savings. Green ICT adoption provided potential for a big South African IT firm to cut operating expenses and improve operational efficiency, consequently increasing the organization's competitiveness.

7.4.1.3 Implementing Green ICT for business sustainability

This subject illustrated how Green ICT practises lead to excellent organisational outcomes. One of the important conclusions was that Green ICT practises are primarily focused on either cost reduction or compliance with government rules or consumer and industry expectations. As previously demonstrated, the ability to lower operating expenses is a major motivator for adopting Green ICT practises and technology. This turned into practises for lowering the enterprise's carbon impact through buying and sourcing. In terms of sourcing, it was discovered that the firm prioritises ecologically preferable IT purchase. According to the findings of the study, the company adopts practises that lead to favourable environmental sustainability results from an operations standpoint. These practises include using power management tools on IT equipment to reduce energy waste. According to the findings of the research, the business has made substantial success in implementing Green ICT technology, such as cloud technologies and server virtualization and consolidation. Furthermore, the organisation has been proactive in terms of technological growth. Several noteworthy developments were identified, including a cloud-based document management system that enables digital document signing. This invention demonstrates the company's dedication to minimising paper use and printing.

7.4.2 Conclusions for research question 2

What are the drivers of the implementation of Green ICT within a large IT company in South Africa, South Africa?

Two conclusions were made under this question namely Covid-19 emergency as a catalyst for Green ICT and Green ICT policy.

7.4.2.1 COVID-19 emergency response as a catalyst for Green ICT implementation

This theme addressed aspects of all three sub-research questions, offering perspectives anchored in the context of the COVID-19 pandemic, specifically perspectives on the approach to Green ICT implementation at a large IT company in South Africa during a global emergency response, as well as the barriers and drivers for implementation in the context of a global pandemic. The subject addressed the unanticipated and unwelcome outcomes of company activities. As part of the emergency reaction to the pandemic, governments throughout the world, imposed lockdowns to prevent the spread of the coronavirus. The lockdowns disrupted human economic and social activities, company operations, supply lines, and people's routine everyday lives all around the world, and participants said that their lives were also significantly impacted. The participants explained how the organization's business activities were impacted, including project pausing, project loss, and loss of business clients.

This study's findings are consistent with those commonly published in the literature on the worldwide consequences of the epidemic. The organisation resumed operations as the lockdowns proceeded, although with personnel working from home. During the lockdowns as part of the emergency response to stop the spread of the coronavirus, numerous organisations adopted the work-from-home practise. It was found that the company assisted employees with the transition to remote work. Telecommuting became the norm, with virtual meetings and video conferencing technologies becoming commonplace. Telecommuting provided benefits such as lower operational expenses for fully occupied workplaces such as heating and cleaning, as well as lower on-premises power use. Additionally, because employees could now work from anywhere, productivity rose.

One of the study's primary conclusions was that the COVID-19 epidemic was a crucial element in making the strategic decision to quickly and largely use the dispersed team model. The organisation functions mostly remotely under this strategy. As a result, the firm receives operational benefits such as a smaller office footprint and corresponding cost

savings owing to lower on-premises energy use and utility usage. Furthermore, because employees could work from anywhere, productivity rose. These advantages expedited the organization's policy of reducing its office footprint and incorporating remote work into its long-term sustainability plan. When it was discovered that the dispersed team model was in line with the organization's business sustainability goals, it was adopted as a crucial approach for recovering from the economic effects of the epidemic. As a consequence, the unusual pandemic produced by COVID-19 may be argued to have been an unexpected and unanticipated catalyst that hastened the deployment of Green ICT practises, resulting in beneficial environmental and business sustainability results for the firm.

The widespread adoption of telecommuting has led to positive environmental sustainability results. With fewer people commuting to work, there has been a decrease in carbon emissions and traffic congestion. Additionally, organizations have seen the benefits of downsizing their office space, resulting in reduced energy consumption and utility usage. These changes have not only had a positive impact on the environment but have also yielded cost savings for businesses. In Chapter 2 of the literature review, the concept of telecommuting and a virtual workforce is highlighted as a significant method for businesses to decrease their carbon footprint. This is achieved by reducing electricity usage, minimizing the need for physical office space and utilities, and decreasing carbon emissions caused by daily commuting. (Nica, 2015; Unhelkar, 2016; Tutusaus et al., 2018). As a result, a distributed workforce did cut carbon footprint while also lowering operational expenses.

7.4.2.2 Green ICT policy

The study concluded that the government must play a role in supporting Green ICT. It was discovered in this study that end-of-life policy affected the disposal of ICT equipment. Government legislation, industry, and consumer expectations, as well as the company's cost-cutting and corporate image objectives, influenced the company's Green ICT practises, such as recycling.

7.4.3 Conclusions for research question 3

What are the barriers to the implementation of Green ICT within a large IT company in South Africa, South Africa?

Under this research question, the following conclusion was made:

7.4.3.1 Green ICT policy is not clearly defined

This theme focused on the extent to which green policies are established and implemented throughout the organization's complete value chain in order to determine if the big ICT firm in South Africa has a clear Green ICT strategy. Consideration was given to the three primary stages of the ICT supply chain, including viewpoints on sourcing and procurement, operations, and service, and, ultimately, ICT product end of life. It is great to see Green ICT concerns being used throughout the organization's whole value chain and in the organization's connections with its suppliers. Policy considerations were taken to address environmentally friendly procurement practises. Initiatives to lower the enterprise's carbon footprint are also guided by operational and end-of-service considerations. The study's findings revealed that a significant South African ICT company's approach to Green ICT had an influence on the organization's whole value chain, from its suppliers to its customers.

The organisation's strategy for implementing Green ICT includes partnering with suppliers who satisfy their environmental requirements. In this regard, the adoption of Green ICT inside a significant South African IT firm demonstrates the Proactive green approach. Nica (2015) stated that a proactive green strategy is made up of systemic wits that influence the whole value chain and supplier relationships. Green ICT Policy refers to the frameworks designed and executed by an organisation to apply environmental sustainability principles throughout its value chain (Verdecchia et al., 2017). However, there was also evidence that

the company lacks a coherent strategy or formal policy framework for Green ICT implementation. As a result, an apparently haphazard collection of tactics is employed. The organization's attitude to Green ICT is mostly reactive. Evidence was presented demonstrating that the organisation's strategy for implementing Green ICT is primarily motivated by the need to respond to external pressure to fulfil customers' environmental criteria and government laws, as well as the need to minimise operating expenses. There is no clearly defined uniform structure for execution as a result of the reactive approach.

Despite the lack of a well-defined Green ICT policy, the study discovered that general corporate policies at a big South African IT company have a favourable impact on the application of Green ICT practises. The first topic demonstrated how the strategy to embrace the distributed team model aided efforts to minimise the enterprise-wide carbon footprint through practises such as telecommuting and onsite energy use. The policy also impacts both practises and the technology that enables Green ICT implementation.

7.5 STUDY CONTRIBUTIONS

There are several studies on Green ICT which have employed case study design to explore how organisations are at the forefront of Green ICT innovation. However, most of the case studies are from the developed world, implying that there is a gap in literature for viewpoints from the poor world. This is one of the rare studies that offers viewpoints on a South African organisation. The study, therefore, contributes to the body of knowledge by considering Green ICT implementation in the South African context.

The study's timing corresponded with the COVID-19 pandemic caused by the coronavirus's propagation. When the bulk of research on the COVID-19 pandemic focused on how the IS field responded to the pandemic, this gave a unique chance to explore the effects of a global crisis and the accompanying emergency reaction on Green ICT adoption. One of the important results was that the COVID-19 pandemic triggered an emergency response, which

served as a catalyst for Green ICT deployment at a significant South African IT organisation. This demonstrates that, while a crisis may have severe and damaging effects on human existence, it may also be a suitable time to reconsider human behaviours and implement actions that contribute to sustainability. Insights from such an initiative might influence future practise and assist build resilience into Green ICT deployment amid a natural or man-made emergency response crisis. As a result, the study adds to the body of knowledge on the use of Green ICT practises during times of crisis. The study investigated the organisational reaction to both the pandemic and environmental crises, offering insights into how environmental conditions produced by the crises impact Green ICT uptake. By expanding the applicability of the GITAM model and establishing an interpretative framework for Green ICT, the provides a theoretical contribution.

Since the study was conducted during a time when the COVID-19 pandemic had an influence on organisations, the results show that, while significant, the Green ICT initiatives prior to COVID-19 were incremental but did not produce the radical transformation seen after the pandemic's spread. The findings demonstrate how major shock effects from external environmental events can disturb the mechanisms that underlie resistance to change. These findings are consistent with previous research that investigated the adoption of general ICTs in different industries, resulting in dramatic changes in business models as required innovations to combat the COVID-19 pandemic (Wendt, Adam, Benlian, & Kraus, 2021; Zamani, Griva, & Conboy, 2022).

Furthermore, the findings of the study contribute to the literature on business model adaptation in response to a crisis, notably through the increased adoption of green technology practises. The research reveals the frameworks required to successfully respond to a crisis by implementing Green ICT practises. Using the Gitam model as a guide, a company's Green ICT capabilities and limits may be viewed as the structure that can either support or inhibit the adoption of a Green ICT practise to adapt a business model in response to a crisis. This study demonstrates how the various structures combine to produce an operational strategy shift that coincides with both commercial and environmental goals.

Finally, the research investigates the conflicts of sustainability goals linked with an organisation's many settings and stakeholders. Several environments connected with stakeholders relevant to an organisation may be described, such as from a natural, economic, organisational, social, ecological, and ethical standpoint (Baskerville et al., 2016). The findings reveal that managing sustainability objectives and expectations from various viewpoints is difficult since different views' sustainability goals frequently clash. A frequent example is a conflict between the aims of social, environmental, and economic sustainability.

The case study demonstrates that the pandemic's unexpected impact disrupted various aspects of the organizational, social, and economic environment, which previously hindered the adoption of remote working as an operational strategy. As a result, companies resorted to implementing remote work to recover from the pandemic's economic consequences by reducing costs and improving efficiency. In the long run, this strategy may help achieve environmental and business sustainability goals through the implementation of Green ICT practices. These findings align with prior research suggesting that environmental and economic sustainability objectives are not mutually exclusive (Baskerville et al., 2016). Instead, environmental initiatives can be leveraged to gain a competitive advantage and promote both environmental and economic sustainability (Hankel et al., 2018).

7.6 STUDY LIMITATIONS

The researcher reflected on concerns arising from research design restrictions are considered. This exploratory research concentrated on a single instance organisation. While focusing on a single business provides for in-depth research findings, the study only addressed viewpoints on a single firm, which may not be representative of the prevalent situation in other South African ICT organisations. Furthermore, an exploratory research on a single organisation is constrained by a lack of systematic comparison and analysis, jeopardising the conclusions' generalizability. This study relied on qualitative data. As the study relies on qualitative data, this raises additional drawback. The ensuing analysis makes it difficult to draw precise conclusions that can be objectively summarised. This is due to the

variety of qualitative data, which makes maintaining impartiality in the examination and interpretation of the obtained data challenging.

7.7 RECOMMENDATIONS FOR FUTURE STUDIES

After acknowledging the constraints of this research, this section offers a concise overview of suggested areas for future study that have emerged from the concerns raised in the previous section.

The GITAM model was used in this investigation. While the model is a generally acknowledged and frequently used standardised instrument for objectively assessing organisational Green ICT uptake and capabilities, it is important to note that the model was not designed to fully consider external environmental factors or unexpected events. To improve our knowledge of the pandemic's impact, the study required to depend on TOE and Punctuated Equilibrium theory. Although the COVID-19 pandemic may be a misnomer, other prospective occurrences such as radical technology developments, conflict, poor media coverage, and natural catastrophes may have an external shock impact on organisations and human activities. In the context of such external shock occurrences, future study may examine the maturity and usefulness of the GITAM model. Furthermore, it is questionable if organisational changes linked to the pandemic's external shock impact will persist as the globe recovers from the epidemic. Future studies might, among other things, expand on this research and use the G-Readiness Index as a tool to assess and compare the organisation's Green ICT capabilities and limits with other organisations in the industry. Future research should also look at which organisational improvements will last and what mechanisms prevent businesses and people from reverting to pre-COVID-19 practises.

7.8 CONCLUSION

This chapter summarises the research by summarising the findings. The study is based on the rising relevance of examining sustainability issues in the field of information systems, with an emphasis on Green ICT as one area of responsible IS research. The study's goal was to create and assess Green ICT implementation guidelines with an emphasis on big organisations, using the case of a large South African ICT company as a case study. The research used the GITAM model as a theoretical lens to analyse the Green ICT organisational capabilities and constraints of a multinational ICT company in South Africa.

The study established that Green ICT implementation aspects are primarily responsible for the organization's capabilities. Cost reduction and the desire to increase operational efficiency and resource utilisation were two significant motivations in the organisation. External pressures include regulatory obligations, consumer expectations, and industry standards, all of which place pressure on the company to integrate environmental sustainability issues in its corporate image plan. As a consequence of these critical aspects, the organisation established technological skills and ICT infrastructure that incorporates environmental sustainability concerns throughout the whole system and across the full life cycle of ICT products. Employees are encouraged to contribute to sustainable results, and sustainability is also addressed in client and supplier partnerships.

Despite these good findings, the investigation discovered that the company lacks a cohesive and comprehensive Green ICT policy. Due to the lack of a coherent model detailing environmental goals, this shows to be the most important risk to successfully integrating Green ICT in the firm. A thorough strategy would also specify roles and duties for green projects, as well as provide accountability structures and procedures for assessing sustainability KPIs. One of the most important contributions of this study was the ability to investigate the effects of a worldwide catastrophe and the ensuing emergency reaction to the COVID-19 pandemic on Green ICT deployment. In the example of the big South African ICT firm, the study concluded that the COVID-19 pandemic triggered an emergency reaction

that served as a catalyst for Green ICT deployment. The emergency response necessitated the rapid implementation of the dispersed teamwork model, which is an essential component of the organization's Green ICT capabilities. The findings demonstrate that remote work, as a long-term practise, aided in the development of organisational resilience throughout the epidemic. The report presented a framework for Green ICT deployment. Future study might look at the implementation of Green ICT policies in both commercial and governmental institutions, using quantifiable key performance indicators. This will help to establish South Africa's progress in terms of Green ICT compliance.

REFERENCES

ABDULLAH, M., ZAILANI, S., IRANMANESH, M. & JAYARAMAN, K. 2016. Barriers to green innovation initiatives among manufacturers: The Malaysian case. *Review of Managerial Science*, 10(4):683-709.

ADAM, P., OVSEIKO, P V., GRANT, J., GRAHAM, K. E., BOUKHRIS, O. F., DOWD, A. M., BALLING, G. V., CHRISTENSEN, R. N., POLLITT, A., TAYLOR, M., SUED, O., HINRICHSKRAPELS, S., SOLANS-DOMÈNECH, M. & CHORZEMPA, H. 2018. ISRIA statement: Ten-point guidelines for an effective process of research impact assessment. *Health Research Policy and Systems*, 16(1): 8-18.

ADNAN, N., NORDIN, S. M. & ALI, M. 2018. A solution for the sunset industry: Adoption of Green Fertiliser Technology amongst Malaysian paddy farmers. *Land use policy*, 79:575-584.

AH-LIAN, K., ERIC, R., KARL, A., JARI, P. & GEORGES, J.P. 2019. Education in Green ICT and control of smart systems: A first-hand experience from the International PERCCOM masters programme. *IFAC-PapersOnLine*, 52 (9):1-8.

AJZEN I. 1991. The theory of planned behaviour. *Organizational Behaviour and Hum. Decision Processes,* 50: 179-211.

AL-ABABNEH, M.M. 2020. Linking ontology, epistemology, and research methodology. *Science & Philosophy,* 8(1): 75-91

ALSHEHHI, A., NOBANEE, H & KHARE, N. 2018. The impact of sustainability practices on corporate financial performance: literature trends and future research potential. *Sustainability*, 10(494): 4-25.

ALSULTANNY, Y. A. & ALNASSAR, F. M. 2017. Evaluating factors motivate users on Green IT readiness (Part 2). *International Journal of Green Computing (IJGC)*, 8 (1):23-35.

ANTHONY, B. J. 2016. Green information systems integration in information technology based organisations: an academic literature review. *Journal of Soft Computing and Decision Support Systems*, 3 (6):45-66.

ANTHONY, B. J. & MAJID, M. A. 2016. Development of a Green ICT model for sustainable enterprise strategy. *Journal of Soft Computing and Decision Support Systems*, 3 (3):1-12.

ARA, F. 2018. Barriers to implement Green ICT in Bangladesh: A study on organisations. *International Journal of Computer Applications*, 179(34): 43-47.

AREGUAMEN D. O., CRITCHLOW K., DERESHWISKY M. & MUHAMMAD B 2022. Strategies for Enhancing Nigeria's Procurement Procedures. American Journal of Industrial and Business Management. 12 (13), 331-364.

ARPAD, T. 2018. Willing to pay to save the planet? evaluating support for increased spending on sustainable development and environmentally friendly policies in five countries. *PLoS ONE*, 13(11): e0207862.

ASABERE, N.Y., ACAKPOVI, A & QUAYNOR, N. 2016. Encouraging Green ICT implementation strategies in polytechnic education in Ghana. *International Journal of Applied Information Systems,* 10(6):14-21.

ASONGU, S.A., LE ROUX, S. & BIEKPE, N. 2017. Environmental degradation, ICT, and inclusive development in Sub-Saharan Africa. *Energy Policy*,111(12): 353–361.

ASSAf. 2014. The State of Green Technologies in South Africa. Available from: hta large IT company in South Africa:// www.assaf.org.za/files/2015/05/8-Jan-2015-WEB-526305-ASSAF-Green-Techmail.pdf [Accessed on: 31 May 2022].

Aspers, P. & Corte, U. 2019. What is qualitative in qualitatiove research. *Qualitative Sociology*, 42: 139–160.

ATSU, F., ADAMS, S. & ADJEI, J. 2021. ICT, energy consumption, financial development, and environmental degradation in South Africa. Heliyon, 7(7): e07328.

BADAMI, B. 2013. *The assessment of green information technology adoption and readiness in Iranian companys*. Masters thesis, Multimedia University.

BAEK, H. & PARK, S.K. 2015. Sustainable development plan for Korea through expansion of green IT: Policy issues for the effective utilization of big data. *Sustainability*, 7 (2):1308-1328.

BAKER, J. 2012. *The technology-organization-environment framework. Information systems theory*. New York: Springer.

BEAUCHAMP, T.L. & CHILDRESS, J.F. 2009. *Principles of biomedical ethics. New York (NY)*: Oxford University Press.

BERNOVA, N.F., INDAH, D.R., HEROZA, R.I., RACHMADITA, T.A., SEPTIANI, A.S & CAHYANI, R.D. 2019. Theory of reasoned action implementation on knowledge sharing process between alumni and college students. *Advances in Intelligent Systems Research,* 172: 572-580.

BAILEY, J. S. & BURCH, M. R. 2017. *Research methods in applied behaviour analysis.* London: Taylor and Francis.

BANKS, M. & ZEITLYN, D. 2015. *Visual methods in social research.* London: Sage.

BASKERVILLE, R., PRIES-HEJE, J.& RECKER, J. 2016. Principles for re-designing information systems for environmental sustainability. In IFIP World Information Technology Forum (pp. 14-25). Springer, Cham.

BAZIRE, M. & BRÉZILLON, P. 2005. *Understanding context before using it.* Verlag Berlin Heidelberg: Springer.

BEKAROO, G., BOKHOREE, C. & PATTINSON, C. 2016. Impacts of ICT on the natural ecosystem: A grassroot analysis for promoting socio-environmental sustainability. *Renewable and Sustainable Energy Reviews*, 57(3):1580-1595.

BENOOT, C., HANNES, K & BILSEN, J.2016. The use of purposeful sampling in a qualitative evidence synthesis: A worked example on sexual adjustment to a cancer trajectory. *BMC Medical Research Methodology*, 16(21): 2-12.

BERAN, J., FENG, Y. AND HEBBEL, H. 2014. *Empirical economic and financial research: theory, methods, and practice.* Cham: Springer.

BEREZIN, M. 2014. How do we know what we mean? Epistemological dilemmas in cultural sociology. *Qualitative Sociology,* 37(2): 141–151.

BOAKYE, D. 2018. The Relationship between Environmental Management Quality and Financial Performance of AIM listed Companys. Ph.D. Thesis, Bournemouth University, Bournemouth.

BOHAS, A. & POUSSING, N. 2016. An empirical exploration of the role of strategic and responsive corporate social responsibility in the adoption of different Green IT strategies. *Journal of cleaner Production*, 122:240-251.

BOK, E. S. 2019. Adopting green information and communication technology: barriers for South African small and medium enterprises. Doctoral dissertation, University of South Africa.

BOKOLO, A. J., MAJID, M. A. & ROMLI, A. 2017. Green information technology system practice for sustainable collaborative enterprise: a structural literature review. *International Journal of Sustainable Society*, 9 (3):242-272.

BOKOLO, A. J., MAJID, M. A. & ROMLI, A. 2018. A proposed model for green practice adoption and implementation in information technology based organisations. *Problemy Ekorozwoju*, 13 (1):95-112

BORAH, A.D., MUCHAHARY, D., SINGH, S.K & BORAH, J. 2015. Power saving strategies in green cloud computing systems. *International Journal of Grid Distribution Computing,* 8, (1): 299-306.

BORGMAN, H.P., BAHLI, B., HEIER, H. & SCHEWSKI, F. 2013. Cloudrise: Exploring cloud computing adoption and governance with the toe framework. 2013 46th Hawaii International Conference on System Sciences, Wailea, Maui, HI, January 7-10, 2013, pp. 4425-443.

BRANT, J. & PANJWANI, F. 2015. School Economics and the Aims of Education: Critique and Possibilities. *Journal of Critical Realism*, 14(3):306-324.

BRAUN, V. & CLARKE, V. 2019. Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health,* 11 (4): 589-597.

BRAUN, V. & CLARKE, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology,* 3(2): 77-101.

BRIDGMAN, T. & WILLMOTT, H. 2006. Institutions and technology: Frameworks for understanding organisational change—The case of a major ICT outsourcing contract. *The Journal of Applied Behavioral Science*, 42 (1):110-126.

BRYMAN, A. 2015. *Social research methods.* London: Oxford university press.

BRYMAN, A. & BELL, E. 2015. *Business research methods.* London: Oxford University Press.

BRYMAN, A., BELL, E., HIRSCHOHN, P., DU TOIT, J., DOS SANTOS, A., WAGNER, C. & VAN AARDT, I. (2014). *Research methodology: Business and management contexts.* Southern Africa: London: Oxford University Press.

BUBA, A.K & IBRAHIM, O. 2021. Behavioural Model for Decision-Makers' towards the Intention to Adopt Green Information Technology: A Preliminary Study. *Pertanika Journal of Science & Technology,* 29 (4): 2409-2434.

BUCHALCEVOVA, A. 2015. Green ICT maturity model for Czech SMEs. *Journal of Systems Integration*, 6 (1): 24-36.

BUCHALCEVOVA, A. 2016. Analysis of the management of business informatics framework from the Green ICT viewpoint. *International Journal of Information Technology and Management*, 15 (1):41-58.

BUDI, S., AFIFF, A.Z & HERUWASTO, I. 2021. Personal norm and pro-environmental consumer behavior: An application of norm activation theory. *ASEAN Marketing Journal*, 13(1): 36-43.

Butler, Tom, "TOWARDS A PRACTICE-ORIENTED GREEN IS FRAMEWORK" (2011). ECIS 2011 Proceedings. 102. https://aisel.aisnet.org/ecis2011/102 [Accessed: 22 September 2022].

BUTLER, T., DALY, M. & HACKNEY, R. 2015. Socio-technical transitions towards environmental sustainability through Green ICT. 2015 International Conference on Information Systems (ICIS 2015), Texas, (13-16 December 2015). Available from: http://bura.brunel.ac.uk/handle/2438/11847 [Accessed: 15 January 2022].

CALERO, C. & PIATTINI, M. 2015. *Green in software engineering.* Cham: Springer.

CAMPBELL, W. M. 2017. An exploration of the impact of the use of standard management models on the adoption of Green IT. In: Proceedings of GREEN 2017: The Second International Conference on Green Communications, Computing and Technologies. IARIA, pp. 5-11.

CANTORE, N., NUSSBAUMER, P., WEI, M. & KAMMEN, D.M. 2017. Promoting renewable energy and energy efficiency in Africa: A framework to evaluate employment generation and cost effectiveness. *Environmental Research Letters,* 12(3): 1–11.

CHETTY, M., BRUSH, A. B., MEYERS, B. R. & JOHNS, P 2009. It's not easy being green: understanding home computer power management. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* pp. 1033–1042.

CHITECHI, K.V & ODOYO, C.O. 2020. Emerging trends for energy consumption within ICT devices. *International Journal of Engineering Applied Sciences and Technology,* 5(3):136-141.

CHU, S., YANG H., LEE, M. & PARK, S. 2017. The impact of institutional pressures on green supply chain management and company performance: top management roles and social capital. *Sustainability,* 9(5):1-21.

CHOW, W.S. & CHEN, Y. 2009. Intended Belief and Actual Behavior in Green Computing in Hong Kong. *Journal of Computer Information Systems*, 50(2): 136-141.

CICI, C. & D'ISANTO, D. 2017. Integrating Sustainability into Core Business. *Symphonya Emerging Issues in Management***,**1:50–65.

CLARK, P.B. 1995. Management information systems professionals—The requirement to be true Renaissance people within the organization. *Journal of International Information Management*, 4(2): 71-80.

CLIGGETT, L. 2013. Qualitative data archiving in the digital age: Strategies for data preservation and sharing. *The Qualitative Report* 18(24): 1-11.

COLEMAN, S., TOUCHIE, M.F., ROBINSON, J.B & PETERS, T. 2018. Rethinking performance gaps: a regenerative sustainability approach to build environment performance assessment. *Sustainability,* 10(12):1-22

COOPER, V. A. & MOLLA, A. 2014. Absorptive capacity and contextual factors that influence green IT assimilation. *Australasian Journal of Information Systems*, 18 (3):271-288

CRESWELL, J.W. & HIROSE, M. 2019. Mixed methods and survey research in family medicine and community health. *Family Medicine and Community*, 7:1-6

CRESWELL, J.W. & POTH, C.N. 2018. *Qualitative Inquiry and Research Design Choosing among Five Approaches. 4th Edition*, SAGE Publications, Inc., Thousand Oaks.

CRESWELL, J. W. & CRESWELL, J. D. 2017. *Research design: Qualitative, quantitative, and mixed methods approaches.* London: Sage publications.

CROSSMAN, A. 2020. *Understanding Purposive Sampling: An Overview of The Method and Its Applications*. Available from: https://www.thoughtco.com/methodology/qualitative-qualitative-research [Accessed 16 June 2022].

DAVIES-SRAMEK, B., OMAR. A. & GERMAIN, R. 2017. Leveraging supply chain orientation for global supplier responsiveness: The impact of institutional distance. *The international journal of logistics management,* 30(1): 39-56.

DENG, Q. & JI, S. 2015. Organisational green IT adoption: concept and evidence. *Sustainability*, 7 (12):16737-16755.

DEZDAR, S. 2017. Green information technology adoption: Influencing factors and extension of theory of planned behavior. *Social Responsibility Journal*, 13(2): 292-306.

DÍAZ-GARCÍA, C., GONZÁLEZ-MORENO, A & SÁEZ-MARTÍNEZ, F.J. 2015. Eco-innovation: insights from a literature review. *Innovation,* 17(1): 6-23.

DI PILLO, F., GASTALDI, M., LEVIALDI, N. & MILIACCA, M. 2017. Environmental Performance Versus Economic-financial Performance: Evidence from Italian Company's. *International Journal of Energy and Economic Policy*, 7(2): 98–108.

DOHN, N.B., HANSEN, S.B. & KLAUSEN, S.H. 2018. On the concept of context. *Educational sciences*, 8(111):1-17.

DOLCI, D. B., LUNARDI, G. L., SALLES, A. C. & ALVES, A. P. F. 2015. Implementation of green IT in organisations: a structurational view. *Revest de Administração de Empresas*, 55 (5):486-497.

DU, Q. & KANG, J. T. 2016. Tentative ideas on the reform of exercising state ownership of natural resources: Preliminary thoughts on establishing a state-owned natural resources supervision and administration commission. *Jiangxi Social Science*, 6:160-167.

DUDOVSKIY, J. 2018. *The Ultimate Guide to Writing a Dissertation in Business Studies: A Step-by-Step Assistance*. Pittsburgh New York: Jonathan.

EFFENDI, I., MURAD, M., RAFIKI, A & LUBIS, M.M. 2021. The application of the theory of reasoned action on services of Islamic rural banks in Indonesia. *Journal of Islamic Marketing*,12 (5): 951-976

ERIKSSON, P. & KOVALAINEN, A. (2015). *Qualitative methods in business research: A practical guide to social research. London:* Sage.

EKINS, P & ZENGHELIS, D. 2021. The costs and benefits of environmental sustainability. Sustainability Science, 16(3):949-965

ESFAHANI, M. D., SHAHBAZI, H., NILASHI, M. & SAMAD, S. 2018. Green IT/IS Adoption within organisations: A Systematic Literature Review and Research Agenda. *Journal of Soft Computing and Decision Support Systems*, 5 (5):8-42.

FARKHONDEH, M.R., REZA, R., MASOUD, Z. & ZEYNAB, R. 2022. Empirical Evaluation of Iranian CIO Perspective with Adoption of Green Information Technology. Empirical evaluation of Iranian CIO perspective with adoption of Green Information technology. *Discrete Dynamics in Nature and Society,* 2022: 1-11.

FELDMAN, M. S. & ORLIKOWSKI, W. J. 2011. Theorizing practice and practising theory. *Organisation Science*, 22 (5): 1240-1253.

FERNANDEZ, H., PROCACCIANTI, G. & LAGO, P. 2015. Economic aspects of Green ICT. *Green in Software Engineering.* Springer.

FERNANDO, Y., BEE, P.S., JABBOUR, C.J.C. & THOMÉ, A.M.T. 2018. understanding the effects of energy management practices on renewable energy supply chains: implications for energy policy in emerging economies. *Energy Policy,* 118: 418-428.

FLEMMING, Z. 2017. Methodologies, methods and ethical considerations for conducting research in work integrated learning. *International Journal of Work Integrated*, (3): 205–213.

FLICK, U. 2015. *Introducing research methodology, A beginner's guide to doing a research project.* Sage.

FLUET, B. 2021. What is descriptive research? Invoke. Available at: https://invoke.com/blog/what-is-descriptive-research [Accessed: 11June 2022].

FOWLER, F.J. 2014. *Survey research methods*. 5th ed. Thousand oaks: Sage Publications.

FOOGOOA, R., BOKHOREE, C. & DOOKHITRAM, K. 2015. Green ICT maturity models Towards a general approach. *2015 International Conference on Computing, Communication and Security (ICCCS).* IEEE.

FRANZ, R. S. 2012. Role of business: a portfolio model of corporate social responsibility. *Journal of Global Responsibility*, 3(1): 83-110.

GALPIN, T.; WHITTTINGTON, J.L. & BELL, G. 2015. Is your sustainability strategy sustainable? Creating a culture of sustainability. *Corporate Governance International Journal of Business in Society*, 15(1): 1–17.

GAO, J., HUANG, Z., & ZHANG, C. 2017.: An Application of Norm-Activation Theory. Journal of Sustainable Tourism, 25(2):276- 291.

GAO, C., NA, H., SONG, K., TIAN, F., STRAWA, N. & DU, T. 2020. Technologies-based potential analysis on saving energy and water of China's iron and steel industry. *Science of the Total Environment*, 699: 134225.

GENTLES, S. J., CHARLES, C., PLOEG, J. & MCKIBBON, K. A. 2015. Sampling in qualitative research: Insights from an overview of the methods literature. *The Qualitative Report*, 20 (11): 1772-1789.

GHANI, N.A. 2022. Green Technology Implementation Model for Sustainability. *Journal of Enterprise and Business Intelligence,* 2(1): 17-23.

GILL, A.A., ANSARI, A.H & TUFAIL, M.W. 2021. Going green: Theory of reasoned action application to examine the consumer intention through mediating role of green technology beliefs. Review of *Applied Management and Social Sciences (RAMSS),* 4(1):63-77.

GONEL, F. & AKINCI, A. 2018. How does ICT- use improve the environment? The case of Turkey. *World Journal of Science, Technology and Sustainable Development,* 15(1):2-12.

GRINYER, A. 2019. The ethics of the secondary analysis and further use of qualitative data. *Social Research Update*, Issue 56. Available from: https://sru.soc.surrey.ac.uk/SRU56.pdf [Accessed: 20 November 2022].

GU, Q.; & BOZZELLI, P. 2015. A decision-making model for adopting Green ICTs. In Calero Munoz, C. and Piattini, M. (Eds). *Green in Software Engineering*. Sustainability, 10(8): 2952-2960.

GUYER P. 2003. Kant on the theory and practice of autonomy. *Social Philosophy and Policy,* 20(2):70–98.

HALGAHAGAMA, S.S. & KAVIRATHNA, C.A. 2022. Factors influencing behavioural intention towards green computing practices: A systematic literature review. Proceedings of the 14th Symposium on Applied Science, Business & Industrial Research 2022.

HANKEL, A., HEIMERIKS, G. & LAGO, P. 2018. A systematic literature review of the factors of influence on the environmental impact of ICT. *Technologies*, 6 (3):2-19.

HANKEL, A., HEIMERIKS, G. & LAGO, P. 2019. Green ICT adoption using a maturity model. *Sustainability*, 11 (24): 1-21.

HART, O. A., OJIABO, U., EMECHETA, B.C. & LIU, S. (2016). Using T-O-E theoretical framework to study the adoption of ERP solution. *Cogent Business & Management,* 3(1):1-16.

HEEKS, R., SUBRAMANIAN, L & JONES, C. 2015. Understanding e-waste management in developing countries: strategies, determinants, and policy implications in the Indian ICT sector. *Information Technology for Development,* 21(4):653-667.

HERNANDEZ, A. A. 2020A. Exploring the Factors to green it adoption of SMEs in the Philippines. *Start-ups and SMEs: Concepts, methodologies, tools, and applications. IGI Global*. 907-926.

Hernandez, A. A. 2020b. Green IT adoption practices in education sector: a developing country perspective. *Waste Management: Concepts, Methodologies, Tools, and Applications. Journal of Caes on Information Technologgy*, 20(2):49-66

HERNANDEZ, A. A. & ONA, S. E. 2016. Green IT adoption: lessons from the Philippines business process outsourcing industry. *International Journal of Social Ecology and Sustainable Development (IJSESD)*, 7 (1): 1-34.

HEWSON, C. & STEWART, D. W. 2016. *Internet research methods.* Wiley Online Library.

HOTI, E. 2015. The technological, organizational, and environmental framework of is innovation adaption in small and medium enterprises. evidence from research over the last 10 years. *International Journal of Business and Management*, 3(4): 1-14.

ICT FOOTPRINT EU. 2023. The environmental impact of ICT: reducing the ICT footprint and rethinking progress & technology with sustainability in mind. Available at: http://ictfootprint.eu/en/news/environmental-impact-ict-reducing-ict-footprint-and-rethinking-progress-technology (Accessed: 20 June 2023).

Iphofen, R. 2017. *Finding Common Ground-Consensus in Research Ethics Across the Social Sciences.* Emerald Group Publishing.

IRFAN, M. & PUTRA, S. J. 2020. Readiness measurement of IT implementation in Higher Education Institutions in Indonesia. *Telkomnika*, 18 (2): 860-875.

IRFAN, M., PUTRA, S. J. & ALAM, C. N. 2018b. E-readiness for ICT implementation of the higher education institutions in Indonesia. *2018 6th International Conference on Cyber and IT Service Management (CITSM).* IEEE.

IRFAN, M., PUTRA, S. J. & RAMDHANI, M. A. 2019. The readiness model of information technology implementation among universities in Indonesia. *Journal of Physics: Conference Series,*1175:1-10

IRFAN, M., PUTRA, S., ALAM, C., SUBIYAKTO, A. & WAHANA, A. 2018A. Readiness factors for information system strategic planning among universities in developing countries: A systematic review. *Journal of Physics: Conference Series,* 978(1):1-7

JABBOUR, C. J. C., DE SOUSA JABBOUR, A. B. L., GOVINDAN, K., DE FREITAS, T. P., SOUBIHIA, D. F., KANNAN, D. & LATAN, H. 2016. Barriers to the adoption of green operational practices at Brazilian companies: effects on green and operational performance. *International journal of production research*, 54 (10): 3042-3058.

JACKSON, R., DRUMMOND, D. K. & SAKILE, C. 2017. What is Qualitative Research? *Qualitative Research Reports in Communication*, 3(2):21-28.

JACA, C., PRIETO-SANDOVAL, V., PSOMAS, E. & ORMAZABAL, M. 2018. What should consumer organisations do to drive environmental sustainability? *Journal of Cleaner Production*, 181: 201-208

JAYAPRAKASH, P & PILLAI, R.R. 2022. The Role of ICT for Sustainable Development: A Cross-Country Analysis. *The European Journal of Development Research, Palgrave Macmillan; European Association of Development Research and Training Institutes* (EADI), 34(1): 225-247.

JERE, J. N., & NGIDI, N. 2020. A technology, organisation and environment framework analysis of information and communication technology adoption by small and medium enterprises in Pietermaritzburg. *South African Journal of Information Management*, *22*(1): 1-9.

KAMILARIS, A., PITSILLIDES, A., FIDAS, C. & KONDEPUDI, S. 2015. Social electricity: The evolution of a large-scale, Green ICT social application through two case studies in cyprus and singapore. *EnviroInfo and ICT for Sustainability 2015.* 29th International Conference on Informatics for Environmental Protection (EnviroInfo 2015) Third International Conference on ICT for Sustainability (ICT4S 2015), pp.138-145.

KAN, M., & FABRIGAR, L.R. 2020. *Theory of Planned Behavior*. *Encyclopedia of Personality and Individual Differences*. Berlin: Springer.

KHAN, S. N., ALJABERI, M. A. & MUAMMAR, S. (2019). Success factors model for green computing implementations. *International Journal of Technology Management & Sustainable Development*, 18 (1):37-54.

KIESNERE, A.L. & BAUMGARTNER, R.J. 2019. Top Management Involvement and Role in Sustainable Development of Companies. In: Leal Filho W., Azul A., Brandli L., Özuyar P.,

Wall T. (eds) *Responsible Consumption and Production. Encyclopaedia of the UN Sustainable Development Goals*. Cham: Springer.

KILLION, L. & FISHER, R. 2018. *Ontology, epistemology: Paradigms and parameters for qualitative approaches to tourism: Theory and Practice*. Bristol: Channel View Publications.

KILKIŞ, Ş. 2016. Sustainability-oriented innovation system analyses of Brazil, Russia, India, China, South Africa, Turkey, and Singapore. *Journal of Cleaner Production,* 130:235-247.

KIRON, D., UNRUH, G., KRUSCHWITZ, N., REEVES, M., RUBEL, H. & FELDE A.M.Z. 2017. Corporate sustainability at a crossroads. [Online]. Available at: http://sloanreview.mit.edu/projects/corporate-sustainability-at-a-crossroads/[Accessed: 14 July 2022].

KIVUNJA, C. 2017.Understanding and applying research paradigms in research educational contexts. *International Journal of Higher Education*, 6(5):25-41.

KLENKE, K. 2016. *Qualitative research in the study of leadership.* Bingley: Emerald Group Publishing Limited.

KLIMOVA, A. 2018. Systematic Literature Review of Using Knowledge Management Systems and Processes in Green ICT and ICT for Greening. *Technology for Smart Futures.* Cham: Springer

KLIMOVA, A., RONDEAU, E., ANDERSSON, K., PORRAS, J., RYBIN, A. AND ZASLAVSKY, A. 2016. An internat'onal Master's program in Green ICT as a contribution to sustainable development. *Journal of Cleaner Production*, 135(1): 223-239.

KRUEGER, R. A. & CASEY, M. A. 2014. *Focus groups: A practical guide for applied research.* London: Sage publications.

KUMAR, S. & GOYAL, N. 2016. Evidence on rationality and behavioural biases in investment decision making, *Qualitative Research in Financial Markets*, 8 (4): 270-287.

LAMPARD, R. & POLE, C. 2015. Practical Social Investigation*: Qualitative and Quantitative Methods in Social Research.* London: Routledge.

LAMORTE-WAYNE, W. 2019. *Behavioural change model*. Boston: Boston University School of Public Health.

LAUTENSCHUTZ, D, ESPANA, S, HANKEL, A, OVERBEEK, S & LAGO, P. 2018. A Comparative Analysis of Green ICT Maturity Models. in B Penzenstadler, S Easterbrook, C Venters & SI Ahmed (eds), *ICT4S2018. 5th International Conference on Information and Communication Technology for Sustainability.* vol. 52, EPiC Series in Computing, EasyChair, Toronto, pp. 153-167.

LAWHON, M. 2013. Dumping ground or country-in-transition? Discourses of e-waste in South Africa. *Environment and Planning: Government and Policy*, 31 (4):700-715.

LEAVY, P. 2017. *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches.* New York*:* Guilford Publications.

LEVY, N. 2005. The good, the bad, and the blameworthy. *Journal of Ethics, Sociology and Philosophy,* 1: 1–16.

LI, L. M. W., MEI, D., LI, W.-Q. & LEE, H. 2020. The relationship between dialectical beliefs and pro environmental behaviors. *Environment and Behavior*, *52*(3): 223–247.

LIN, L. 2009. Data management and security in qualitative research*. Dimensions of Critical Care Nursing,* 28(3):132/137

LINDLOF, T. R. & TAYLOR, B. C. 2017. *Qualitative communication research methods.* London: Sage publications.

LUNDFALL, K., GROSSO, P., LAGO, P. & PROCACCIANTI, G. 2015. The Green Practitioner: A decision-making tool for Green ICT. *EnviroInfo and ICT for Sustainability 2015.* Amsterdam: Atlantis Press.

MCOBREIN, A. V. & ACKAH, M. R. 2019. Green Procurement in an Organization. A Case Study of Unilever Ghana Limited. African Journal of Procurement, Logistics & Supply Chain Management, 1(3): 1-17.

MACNISH, K & VAN DER HAM, J. 2020. Ethics in cybersecurity research and practice, 63(2020):1-10.

MAGUIRE, M & DELAHUNT, B. 2017. Doing a thematic analysis: a practical, step-by-step guide for learning and teaching scholars. The All Ireland Journal of Teaching and Learning in Higher Educatin, 8(3):3351-33514.

MARAKANON, L., PANJAKAJORNSAK, V. 2017. Perceived quality, perceived risk and customer trust affecting customer loyalty of environmentally friendly electronics products. Kasetsart Journal of Social Sciences, 38(1): 24-30.

MARCH, S. T. & NIEDERMAN, F. 2012. The Future of the Information Systems Discipline: A Response to Walsham'.*Journal of Information Technology,* 27(2): 96–99.

MARCEL, Y. (2016. A Conceptual Green ICT Implementation Model Based-on ZEN and G-Readiness Framework. In *2016 International Conference on Informatics and Computing (ICIC).* Lombok, Indonesia. Lombok: International Conference on Informatics and Computing, pp. 99-104.

MARSHALL, C. AND ROSSMAN, G. B. 2014. *Designing qualitative research.* London*:* Sage publications.

MARX, B. & VAN DYK, V. 2011. Sustainability Reporting at Large Public Sector Entities in South Africa. *South African Journal of Accounting Research*, 25(1): 103-127.

MASELE, J.J. 2019. Modelling Green eBusiness Adoption among Small and Medium Tourism Enterprises in Tanzania," The African Journal of Information Systems, 11(3): 209-231.

MASOCHA, R. 2018. Sustainable Marketing Practices and Sustainable Consumer Behaviour of Tertiary Students in South Africa. *Journal of Economics and Behavioural Studies*, 10(3): 248–257.

MENSAH, J & CASADEVALL, S. 2019. Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Social Sciences*, 5(1): 1-15.

MICHENI, E.M. 2015. Using technology organisation environment framework for adoption and implementation of cloud computing in institutions of higher learning in Kenya. *The International Journal of Engineering and Science,* 4(9): 37-43.

MIDDLETON, F. 2019. Reliability and validity: What are the difference? *Scribbor.* http://www.scribbr.com/methodology/reliability-vs-validity/ [Accessed12 February 2022].

MINGERS, J. 2014. *Systems Thinking, Critical Realism and Philosophy: A Confluence of Ideas*. London: Routledge.

MISHRA, D., AKMAN, I. & MISHRA, A. 2014. Theory of reasoned action application for green information technology acceptance. *Computers in Human Behaviour*, 36: 29–40.

MOLLA, A. & ABARESHI, A. 2011. Green IT Adoption: A Motivational Perspective. *PACIS 2011 Proceedings*., pp. 137-145.

MOLLA, A., COOPER, V. A. & PITTAYACHAWAN, S. 2009. IT and eco-sustainability: Developing and validating a green IT readiness model. 22(IJACSA). *International Journal of Advanced Computer Science and Applications*, 4(1): 51-65.

MOLLA, A. & COOPER, V. 2009. Green IT readiness: a framework and preliminary proof of concept. *Australasian Journal of Information Systems Volume,* 16(2):5-23.

MOLLA, A. 2008. GITAM: A Model for the Adoption of Green I. 19th Australasian Conference on Information Systems, 3-5 Dec 2008, Christchurch, pp.658-668.

MOLLA, A., COOPER, V. & PITTAYACHAWAN, S. 2011. The Green IT readiness (G-Readiness) of organisations: An exploratory analysis of a construct and instrument. *Communications of the Association for Information Systems*, 29 (1): 67-96

MONDRAGON, A. E. C., MONDRAGON, C. E. C. & CORONADO, E. S. 2017. ICT adoption in multimodal transport sites: Investigating institutional-related influences in international seaports terminals. *Transportation Research Part A: Policy and Practice*, 97:69-88.

MONSON, M. L. 2020. Critical Evaluation in Pursuit of Socially Responsible Design Science in Information System. *In Proceedings of the 28th European Conference on Information Systems (ECIS)*, An Online AIS Conference, June 15-17, 2020.

MORGAN, D. L. 2014. Pragmatism as a paradigm for social research. *Qualitative Inquiry* 20: 1045–53.

MOUAKKET, S., & ABOELMAGED, M. 2021. Factors influencing green information technology adoption: A multi-level perspective in emerging economies context. *Information Development,* 1(1):1-18.

MULARSKI, R. A., PUNTILLO, K., VARKEY, B., ERSTAD, B. L., GRAP, M. J., GILBERT, H. C., LI, D., MEDINA, J., PASERO, C. & SESSLER, C. N. 2009. Pain management within the palliative and end-of-life care experience in the ICU. *Chest*, *135*(5): 1360–1369.

MURUGESAN, S. & GANGADHARAN, G.R. 2012. Harnessing green IT: Principles and practices. *IT professional*, 10 (1):24-33.

MUSTAFA, M., & ABBAS, A. 2021. Comparative analysis of Green ICT practices among Palestinian and Malaysian in SME food enterprises during covid-19 pandemic. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 18(4): 254-264.

NAIDOO, N. 2019. Guidelines for designing an interpretive Case study for Business and Management doctoral students. Conference: 18th European Conference on Research Methodology for Business and Management Studies. Johannesburg, South Africa, pp.253-263

NAIDOO, M & GASPARATOS, A. 2018. Corporate environmental sustainability in the retail sector: Drivers, strategies, and performance measurement. Journal of Cleaner Production, 203(2018): 125-143

NAIDOO, S. & GOLDSTUCK, A., (2015). *Experience and Lessons from South Africa: An Initial Review*. UN Environment Inquiry/Global Green Growth Institute. Available from: http://sustainablefinanceinitiative.org.za/assets_sfi/downloads/sfi_home_4_experience-and-lessons-from-south-africa-an_initial_review-2016.pdf [Accessed: 2 May 2022].

NEEVEDITAH, P.M.; KARISHMA, A. & DEVI, R.N.2017. Environmental management systems and financial performance: The Case of Listed Companies in Mauritius. *Theoretical Economic Letters*, 7(7): 2054–206.

NIEDLICH, S., KUMMER, B., BAUER, M., RIECKMANN, M. & BORMANN, I. 2020. Cultures of sustainability governance in higher education institutions: a multi-case study of dimensions and implications. *Higher Education Quarterly*,74(4): 373–390.

NICA, E. 2015. ICT innovation, internet sustainability, and economic development. *Journal of Self-Governance and Management Economics*, 3 (3): 24-29.

NIZAM, I., & VILHI, M. 2018. The determinants of Green ICT adoption in foreign multinational organisations in Malaysia. *International Journal of Management, Accounting and Economics,* 5(4): 214-243.

NGUYEN, T.H., YANG, Z., NGUYEN, T.T. & THANH, C.T. 2019. Theory of Planned Behavior Approach to Understand the Influence of Green Perceived Risk on Consumers' Green Product Purchase Intentions in an Emerging Country. *International Review of Management and Marketing*, 9(3): 138-147.

NGUYEN TH, LE XC & VU THL. 2019. An Extended Technology-Organization-Environment (TOE) Framework for Online Retailing Utilization in Digital Transformation: Empirical Evidence from Vietnam. *Journal of Open Innovation: Technology, Market, and Complexity*. 2022; 8(4):200-210.

NGUYEN, Q.A., HENS, L., MACALISTER, C., JOHNSON, L., LEBEL, B., BACH, TAN. S., MANH NGUYEN, H., NGUYEN, T.N. & LEBEL, L. 2018. Theory of reasoned action as a framework for communicating climate risk: A case study of schoolchildren in the Mekong Delta in Vietnam. *Sustainability*, 10(6): 1-14.

OCIEPA-KUBICKA, A. & PACHURA, P. 2017. Eco-innovations in the functioning of companies. *Environmental Research*, 156: 284–290.

ORLIKOWSKI, W. J. 1992. The duality of technology: Rethinking the concept of technology in organisations. *Organisation science*, 3 (3): 398-427.

OTIENO, B., WABWOBA, F.& SHIKHUYU, J., 2019. *A Review of Green ICT Readiness in the Insurance Industry in Developing Nations*. The International Journal of Science & Technology, 7(4):42-53

ÖZER, G & YILMAZ, E. 2019. Comparison of the theory of reasoned action and the theory of planned behaviour: An application on accountants' information technology usage. *International Journal of Management and Business Studies*, 10 (2): 001-009.

PAN, S. L., & ZHANG, S. 2020. From fighting COVID-19 pandemic to tackling sustainable development goals: An opportunity for responsible information systems research. International Journal of Information Management, 55: 102196.

PULLA, V & CARTER, E. 2018. Employing interpretivism in social work research. *International Journal of Social Work and Social and Human Service Practice*, 6(1):9-14.

QAMATA-MTSHALI, N. & BRUCE, J. C. (2018). Self-directed learning readiness is independent of teaching and learning approach in undergraduate nursing education. *Nurse educator*, 43 (5): 277-281.

QI, D., YUN, W. & SHAOBO, J. 2015. Why Organizations Adopt Green IT: A Comprehensive Review" (2015). CONF-IRM 2015 Proceedings, pp 40-45.

Qin Xiliang, Yen-Ku Kuo, Mohammed A. S. Abourehab, Fatma Mabrouk, Edwin Ramirez-Asis, Zulkiflee Abdul-Samad & Nalson Makes (2023) The impact of ICT, green finance, and CSR on sustainable financial performance: moderating role of perceived organizational support, Economic Research-Ekonomska Istraživanja, 36:3, DOI: 10.1080/1331677X.2022.2151489

RADU, L.D. (2016). Determinants of Green ICT adoption in organisations: a theoretical perspective. *Sustainability*, 8 (8): 1-22

RADU, L.D. 2018a. Barriers to Green ICT adoption in Romania. Academic Journal of Economic Studies, 4(4): 28-33.

RADU, L.D. 2018b. Green ICT: Some challenges and potential solutions. *Acta Oeconomica Universitatis Selye*, 7 (2):. 141-150.

RAISINGHANI, M.S. & IDEMUDIA, E.C. 2015. *Green information systems for sustainability.* Hershey: Information Science Reference.

RAVITCH, SM. & CAR, NM. 2016. *Qualitative research bridging the conceptual, theoretical, and methodological.* Singapore: Sage publications.

ROBINSON, O. C. 2014. Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology*, 11 (1): 25-41.

REITER, B. 2017.Theory and Methodology of Exploratory Social Science Research. *International Journal of Science and Research Methodology*, 5(4):129-150.

ROARK, K. 2020. Data Management and Curation for Qualitative Research: Collaborative Curriculum Development and Implementation. *Journal of eScience Librarianship*;9(1): e1185

ROBINSON, S. & STUBBERUD, H. A. 2015. A comparison of methods of creativity in small and large European businesses. *International Journal of Entrepreneurship*, *19*: 140-151.

SAMSON M. (2020). Whose frontier is it anyway? Reclaimer 'integration' and the battle over Johannesburg's waste-based commodity frontier. *Capital Nat Social,* 31(4), 60–75

SARI, W. A. N., NUGROHO, E. & NUGROHO, L. E. 2017. Usulan model G-readiness pada sektor pemerintahan studi kasus: badan pusat statistik di yogyakarta. *Prosiding Semnastek*, Prosiding Seminar Nasional Sains dan Teknolgi., pp 1-12.

SAUNDERS, M., LEWIS, P. (2018). Doing research in Business and Management (2nd ed.). Edinburgh Gate: Pearson.

SAUNDERS, M., LEWIS, P. AND THORNHILL, A. (2016). *Research methods for business students.* Harlow; Munich: Pearson.

SAVITA, K.S., DOMINIC, P.D.D. AND RAMAYAH, T., 2012, June. *Eco-design strategy among ISO 14001 certified manufacturing companies in Malaysia: green drivers and its relationship to performance outcomes*. In 2012 International Conference on Computer & Information Science (ICCIS),1, pp. 154-159.

SCHURINK, W. & FOUCHÉ, C.2021... Qualitative Data Analysis and Interpretations. In A. S. De Vos, H. Strydom, C. B. Fouché, & C. S. L. Delport (Eds.), *Research at Grass Roots*. To the Social Sciences and Human Service Professions (4th ed., pp. 397-423). Pretoria: Van Schaik.

SCHWANDT, T. A. 2014. *The Sage dictionary of qualitative inquiry.* Sage Publications.

SETIAWAN, B., AFIFF, A. Z., & HERUWASTO, I. 2020. Integrating the theory of planned behaviour with norm activation in a pro-environmental context. *Social Marketing Quarterly*, 26(3): 244–258.

SHAMIL, R. 2021. What is explanatory research? (Definition). Available at: http://t4tutorials.com/what-is-explanatory-research-research-methodology/ (Accessed: 7 June 2022).

SHARMA, G. 2017. Pros and cons of different sampling techniques. *International Journal of Applied Research*, 3(7): 749-752.

SEKARAN, U. & BOUGIE, R. 2016. *Research methods for business: A skill building approach.* West Sussex: John Wiley & Sons.

SENDAWULA, K. BAGIRE, V. MBIDDE, C.I. & TURYAKIRA, P. 2020. Environmental commitment and environmental sustainability practices of manufacturing small and medium enterprises in Uganda. *Journal of Enterprising, Communities: People and Places in the Global Economy*, 15(4): 588-607.

SHORTEN, A. AND SMITH, J. 2017. Mixed methods research: Expanding the evidence base. *BMJ*, 20(3): 74-85.

SILEYEW, K.J. 2019. Research design and methodology. *Intechopen*, 85731. Available at: http://www.intechopen.com/books/cyberspace/research-design-and-methodology (Accessed: 26 May 2022).

SILVERMAN, D. 2013. *Doing qualitative research: A practical handbook, Fourth Edition.* London: Sage.

SILVERMAN, D. 2006. What Counts as qualitative research? Some cautionary comments. *Qualitative sociology Review*, 9 (2): 48-55.

SIXAS, V., SMITH, N & MITTON, C. 2017.The qualitative descriptive approach in international comparative studies: Using online qualitative studies. *International Journal of Health Policy and Management*, 7(9): 778-779.

SMITH, J.A. 2015. *Qualitative psychology: A practical guide to research methods.* London: Sage.

SOUSA, S., CORREIA, E., VISEU, C. & LARGUINHO, M. 2022. Analysing the Influence of Companies' Green Communication in College Students' Green Purchase Behaviour: An Application of the Extended Theory of Planned Behaviour Model. *Administrative Sciences,* 12: 80-87.

SREEJESH, S., MOHAPATRA, S. & ANUSREE, M. 2014. *Business research methods: An applied orientation. Cham:* Springer.

STAHL, B. 2006. Responsible computers? A case for ascribing quasi-responsibility to computers independent of personhood or agency. *Ethics and information technology*, 8:205-213.

STEPH, M., GER, P., GAAST, K., KEESTRA, M & KOENDERS, L. 2021. Making a research instrument. Chapters on Interdisciplinary research and research skills. Amsterdam: Amsterdam University press.

SUGANDINI, D., MARGAHANA, H & RAHATMAWATI, I. 2020. Managerial support, time constrain and user pressure on digital technology adoption. In Proceedings of the 2nd International Conference on Inclusive Business in the Changing World (ICIB 2019), pp. 304-309

SURYAWANSHI, K. & NARKHEDE, S. 2015. Green ICT for sustainable development: A higher education perspective. *Procedia computer science*, 70: 701-707.

TAHERDOOST, H. 2016. Sampling methods in research methodology: How to choose a sampling technique for research. *International Journal of Academic Research in Management* (IJARM), 5:18-27.

TARUNA, S., SINGH, P. & JOSHI, S. 2014. Green computing in developed and developing countries. *International Journal in Foundations of Computer Science & Technology* (IJFCST),4(3): 97-102.

TAYLOR, S. J., BOGDAN, R. & DEVAULT, M. 2015. *Introduction to qualitative research methods: A guidebook and resource.* West Sussex: John Wiley & Sons.

THIENGO, H., TAVARES, E. & NOBRE, G. C. 2019. Organisational readiness evaluation on sustainable IT management in the Brazilian context. *International Journal of Innovation and Sustainable Development*, 13 (3-4):314-332.

THONGMARK, M. 2015. Youths' green information and communications technology acceptance and implications for the innovation decision process. *Electronic green Journal,*1(39): 1-20.

TORNATZKY, L. G., FLEISCHER, M., & CHAKRABARTI, A. K. 1990. *Processes of technological innovation.* Lexington: Lexington Books.

TUTUSAUS, M., SCHWARTZ, K. & SMIT, S. 2018. The ambiguity of innovation drivers: The adoption of information and communication technologies by public water utilities. *Journal of cleaner production*, 171:79-85.

UNHELKAR, B. 2016. *Green IT strategies and applications: using environmental intelligence.* Florida: CRC Press.

UNITED NATIONS. 2015. Transforming our world: the 2030 Agenda for Sustainable Development. Available at: http://undocs.org/A/RES/71/1 (Accessed: 12 June 2023).

VARKEY, B. 2021. Principles of clinical ethics and their application to practices. *Medical Principles and Practices,* 30(1): 18-28

VASANTHA, R.N. & HARINARAYANA, N. 2016. *Online survey tools: A case study of Google Forms.* Paper presented at the National Conference on "Scientific, Computational & Information Research Trends in Engineering, GSSS-IETW, Mysore.

VERDECCHIA, R., RICCHIUTI, F., HANKEL, A., LAGO, P. & PROCACCIANTI, G. 2017.. Green ICT research and challenges. *Advances and New Trends in Environmental Informatics.* Cham: Springer.

VERDECCHIA, R., RICCHIUTI, F., HANKEL, A., LAGO, P. &D PROCACCIANTI, G. 2017. Green ICT research and challenges. In *Advances and New Trends in Environmental Informatics.* Cham: Springer

VERSEY, H. S. 2021. Missing pieces in the discussion on climate change and risk: Intersectionality and compounded vulnerability. *Policy Insights from the Behavioural and Brain Sciences*, *8*(1): 67–75.

WABWOBA, F. 2019. Green ICT Policy Maturity for Actualization of Sustainable Computing in Developing Nations. *International Journal of Advanced Computer Science and Applications,* 4(1):51-65

WALSHAM, G. 2012. Are We Making a Better World with ICTs? Reflections on a Future Agenda for the IS Field. *Journal of Information Technology,* 27(2): 87–93.

WALSHAM, G. (1995). Interpretive case studies in IS research: nature and method. *European Journal of Information Systems,* 4: 74–81.

WELLS, P., ABOUARGHOUB, W., PETTIT, S.& BERESFORD, A. 2020. A socio-technical transitions perspective for assessing future sustainability following the COVID-19 pandemic. Sustainability: Science, Practice and Policy, 16(1): 29-36.

WENDT, C., ADAM, M., BENLIAN, A.& KRAUS, S. 2021. Let's Connect to Keep the Distance: How SMEs Leverage Information and Communication Technologies to Address the COVID-19 Crisis. Cham: Springer

WISDOM, J. & CRESWELL, J. 2013. Mixed methods: integrating quantitative and qualitative data collection and analysis while studying patient-centered medical home models. *Patient Centered Medical Home*. Available at: http://pcmh.ahrq.gov/page/mixed-methods-integrating-quantitative-and-qualitative-data-collection-and-analysis/ (Accessed: 21 May 2021).

XU N, FAN X & HU R. 2022. Adoption of green industrial internet of things to improve organizational performance: The role of institutional isomorphism and green innovation practices. Frontiers in Psychology, 13(917533):1-9.

ZAMANI, E. D., GRIVA, A. & CONBOY, K. 2022. Using business analytics for sme business model transformation under pandemic time pressure. Cham: Springer

ZHANG, C. & LIU, C. 2015. The impact of ICT industry on CO2 emissions: a regional analysis in China. *Renewable and Sustainable Energy Reviews*, 44: 12-19.

ZHENG, D. 2014. The adoption of green information technology and information systems: An evidence from corporate social responsibility. PACIS 2014 Proceedings, pp. 237-240.

ZHU, C., LEUNG, V. C., SHU, L. & NGAI, E. C.-H. 2015. Green internet of things for smart world. *IEEE access*, 3:2151-2162.

ZIEMBA, E. 2019a. The contribution of ICT adoption to sustainability: households' perspective. *Procedia Computer Science*, 192:2279-2290

ZIEMBA, E. 2019b. The contribution of ICT adoption to the sustainable information society. *Journal of Computer Information Systems*, 59 (2):116-126.

ZIEMBA, E. (2019c). Exploring Levels of ICT Adoption and Sustainable Development-The Case of Polish Enterprises. *2019 Federated Conference on Computer Science and Information Systems (Fedics's)*. IEEE.

ZUO, J., RAMEEZDEEN, R., HAGGER, M., ZHOU, Z., & DING, Z. 2017. Dust pollution control on construction sites: Awareness and self-responsibility of managers. *Journal of Cleaner Production*, *166*: 312–320

APPENDICES

APPENDIX A: THEMATIC CODING AND CODE GROUPS

Code		Code groups
Business attitude	Concern about climate change, Concern about reducing ICT's power usage, Concerns about sustainable development, competing priorities, lack of expert knowledge, ROI of Green ICT, resistance to change, lack of education and awareness	Challenges
Challenges: Governance	Lack of enforcement, Lack of Metrics for assessing the impact of Green ICT, Lack of organisational culture of environmental sustainability	Challenges
Challenges: policy	No clearly articulated policy	Challenges
COVID-19-related challenges	Adjusting to remote work, Delayed projects, Difficult to monitor employee Green ICT practices, Disruption of business and Supply chain constraints	Challenges
Drivers	Covid: Change attitudes, Covid: Response to emergency, Education and awareness, environmentally conscious peers, environmentally conscious peers	Drivers
Governance drivers	Corporate social responsibility, Cost reduction, Improve Value offering for green Businessclients, Industry standards, Regulations, Governance: Allocation of budgetary and other resources forGreen IT	Drivers
Green ICT IS	Enabler for green Initiatives, increases the positive impact of ICT on the environment, minimises the negative impact of ICT on theenvironment	IS
Green ICT policy	Downscale office footprint, end of life, green recovery, sourcing	Green ICT policy

Green ICT practices	Initiatives to reduce enterprise-wide carbon footprint, Initiatives to reduce energy consumption, End of life practices	
Solutions	Change management, Education and awareness, Expert knowledge, Organisational culture, Recruitment, Upskilling, Allocation of budgetary and other resources, Enforcement of rules and regulations, clearly defined roles, responsibilities, accountability and control for Green IT initiatives, Cloud Technology, Virtualisation	

APPENDIX B: RESEARCHER DECLARATION

RESEARCHER DECLARATION

Hereby I, Isaac Muranganwa (19382317) in my capacity as a Master's student (MIT) (IS) in the Graduate School of Technology Management, University of Pretoria, that:

1 Research subjects will be informed, information will be handled confidentially, research subjects reserve the right to choose whether to participate and, where applicable, written permission will be obtained for the execution of the project (example of permission attached).

2 No conflict of interests or financial benefit, whether for the researcher, company or organisation, that could materially affect the outcome of the investigation or jeopardise the name of the university is foreseen.

3 Inspection of the experiments in loco may take place at any time by the committee or its proxy.

4 The information I furnish in the application is correct to the best of my knowledge and that I will abide by the stipulations of the committee as contained in the regulations.

5 Signed: Imuranganwa Date: 20-04-2021

APPENDIX C: PARTICIPANT INFORMATION LETTER

Dear Sir/Madam,

I am a Master's student in the Graduate School of Technology Management, University of Pretoria.

My research titled **FACTORS INFLUENCING THE IMPLEMENTATION OF GREEN ICT IN LARGE ENTITIES; A CASE OF ABC, SOUTH AFRICA** is about the implementation of Green ICT.

My study aims to determine the factors that determine the successful implementation of Green ICT and provide an assessment of the implementation of Green ICT by ABC and further identify means, and solution towards ensuring the best practices in Green ICT by the organisation as well as enhancing its contribution towards a green economy.

The purpose of this questionnaire is to gather information about your experiences, views and beliefs concerning environmentally friendly computing (Green ICT).

You were chosen as a respondent because of your use of ICT in accomplishing your work.

Your participation is voluntary, and you can withdraw at any time without penalty. Throughout the survey your privacy will be protected and your participation will remain confidential. I do not wish to analyse data individually and all the data will be transferred to a computer programme to analyse the entire group. This means that you are assured of anonymity.

If you agree to participate, please kindly to the question below with a X in the box next to "Yes, I am available", indicating that you are available. By responding to my email with a 'Yes", you indicate that you voluntarily participate in this research. If you have any concerns, please contact me with the detail provided below.

Researcher name: Isaac Muranganwa

Email: u19382317@tuks.co.za

Phone: 0765725684

Responded no ....

Question 1: Do you choose to Voluntarily participate in this research interview?

By answering "Yes" to this question, I hereby voluntarily grant my permission for participation in this anonymous interview. The nature and the objective of this research have been explained to me and I understand it.

I understand my right to choose whether to participate in the research project and that the information provided will be handled confidentially. I am aware that the results of the interview may be used for academic publication.

Yes, I am available ☐

No, I am not available ☐

APPENDIX D: SEMI-STRUCTURED INTERVIEW GUIDE

Research Topic:

FACTORS INFLUENCING THE IMPLEMENTATION OF GREEN ICT IN LARGE ENTITIES; A CASE OF ABC, SOUTH AFRICA.

Course	MIT (IS) University of Pretoria
Student	I Muranganwa (u19382317)
Email:	u19382317@tuks.co.za
Phone:	0765725684

Research Interview Questions (about 1hr)

Participant number .....

Question 1: Do you choose to Voluntarily participate in this research interview?

By answering "Yes" to this question, I hereby voluntarily grant my permission for participation in this anonymous interview. The nature and the objective of this research have been explained to me and I understand it.

I understand my right to choose whether to participate in the research project and that the information provided will be handled confidentially. I am aware that the results of the interview may be used for academic publication.

Question 2: How long have you been working for ABC?

Question 3: What is your role in ABC?

Question 4: What are your day to day activities in ABC?

Question 5: How do you use ICT within ABC?

Question 6: Does your role allow you to influence ICT Policies within ABC?

Question 7: What do you understand by Green ICT and how is it viewed with your organisation?

Question 8: What is the importance of implementing Green ICT within your organisation?

Question 9: Which strategy do you use, if any, in implementing Green ICT within your organisation?

Question 10: How does Green ICT relate to the overall strategies of your organisation?

Question 11: What are the Green ICT practices you have implemented? Why?

APPENDIX E: RESEARCH APPROVAL

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering,
Built Environment and Information Technology

1956 – 2016
60
years of
Engineering Education

10 March 2021

To whom it may concern

Research proposal approved: Mr Isaac Muranganwa

Mr Muranganwa (Student nr. 19382317) is registered for MIT (IS) at the University of Pretoria.

Supervisor: Prof Rennie Naidoo

Research topic is: Factors influencing the implementation of green ICT in large entities; A case of ABC, South Africa.

I herewith confirm that Mr Muranganwa research proposal has been approved. He may continue with the planning of his data collection, as well as his ethics application.

Kindest regards

Prof C de Villiers
Acting Head of Department: Informatics
012 420 3798
Rhona.vandermerwe@up.ac.za

University of Pretoria, Private Bag X20
Hatfield 0028, South Africa
Tel +27 (0)12 420 4111
Fax +27 (0)12 420 4555
www.up.ac.za
https://www.facebook.com

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie
Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

APPENDIX F: ETHICAL CLEARANCE LETTER

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

7 May 2021

Reference number: EBIT/31/2021

Mr I Muranganwa
Department: External department
University of Pretoria
Pretoria
0083

Dear Mr I Muranganwa

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Approval is granted for the application with reference number that appears above.

1. This means that the research project entitled "FACTORS INFLUENCING THE IMPLEMENTATION OF GREEN ICT IN LARGE ENTITIES; A CASE OF ABC, SOUTH AFRICA" has been approved as submitted. It is important to note what approval implies. This is expanded on in the points that follow.
2. This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Research Ethics Committee.
3. If action is taken beyond the approved application, approval is withdrawn automatically.
4. According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.
5. The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof K.-Y. Chan
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY