A Paradox of the Second Order Digital Divide in Higher Education Institutions of Developing Countries: Case of Zimbabwe

by

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Declaration

I hereby declare that

A Paradox of the Second Order Digital Divide in Higher Education Institutions of Developing Country: Case of Zimbabwe

is my own work, and all sources have been acknowledged by references.

Signed by candidate

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S. DUBE

Preface

Parts of this thesis have already appeared in publications. These include:

Conference proceedings:

- An empirical study on the use of the Sakai Learning Management System (LMS): Case of NUST, Zimbabwe. *Proceedings of the e-Skills for Knowledge Production and Innovation Conference*, Cape Town, South Africa, November 2014.
- Students' perceptions about learning management systems in education: Case of Zimbabwe. *Proceedings of the 15th European Conference on e-Learning (ECEL 2016)*, Prague, Czech Republic, October 2016, pp. 174-182.
- The new generation of students' ICT needs and expectations: Case of a developing country. *Proceedings of the 46th Annual Conference of the Southern African Computer Lecturers' Association (SACLA 2017)*, Magaliesburg, South Africa., July 2017, pp. 101-108.
- Educators' pedagogical concerns on blending ICTs in teaching. *Proceedings of the 16th European Conference on e-Learning (ECEL 2017)*, Porto, Portugal, October 2017, pp. 150-155.

Journal publications:

- A survey of the university students' perspectives about using digital technologies in education: Zimbabwean case. *IAFOR Journal of Education*, Volume 5, Issue 1, 2017, pp. 123-139.
- The use of e-learning systems for pedagogy: What Zimbabwean educators say. *International Journal of Advances in Computer Science & its Applications (IJCSIA)*, Volume 7, Issue 1, 2017, pp. 67-71.

Book chapter:

- The organisational constraints of blending e-learning tools in education: Lecturers' perceptions. *Information Technology-New Generations*, 2018, Chapter /10.1007/978-3-319-54978-1_42, pp. 305-310, Springer, Cham.

This acceptance by the scholarly community has given motivation and provided direction to the production of this thesis. In all cases, the published works have been re-formatted, updated and synthesized into this thesis.

Abstract

Although this is not a new research phenomenon, the literature has often associated the digital divide (second order or otherwise) with sociodemographic, sociocultural and socioeconomical factors as reasons for the digital divide. However, there is little presence in the literature into the underlying structures (physical or abstract arrangement) leading to the divide. This means that the underlying structures leading to this problem have so far been ignored and require scholarly attention. This study, therefore, identifies and explains the structures leading to the second order digital divide, a problem relating to the unequal use of information and communication technologies (ICTs) which is more prevalent in the higher education institutions (HEIs) of developing countries.

Before the structures that lead to the second order digital divide could be explained the interlocking dynamics of ICT adoption needed to be identified. Structuration Theory was employed as a sensitising tool for collecting, analysing, and interpreting qualitative data for this interpretivist research. Novel qualitative data were collected from a purposive sample drawn from a single HEI of Zimbabwe, a developing country of high literacy.

Directed content analysis generated insightful explanations of the structures leading to the second order digital divide at the HEI case. Preliminary analysis based on a deductive logic approach identified signification, domination, and legitimation as some of the structures leading to the second order digital divide at the HEI case. Further analysis based on an inductive logic approach revealed additional belief, institutional and governance structures which manifested from the interlocking dynamics of ICT adoption, involving resources, leadership, adoption behaviours and empowerment.

These findings contributed to practice by explaining the underlying structures of the second order digital divide, for the benefit of ICT4D researchers, and by suggesting interventions to HEI policy-makers for reducing the second order digital divide. The results also make an

explanatory contribution to theory by presenting a model of the interlocking dynamics of ICT adoption for theorising about the complex second order digital divide.

Acknowledgements

My greatest appreciation goes to Jehovah my God who kept me alive and gave me the required strength I needed to pull through this difficult journey.

My love and appreciation also go to my wonderful family who stood by me always even during the darkest moments of my life while trying to make this research a success. I thank my father, Saul Sibanda who has always been my inspiration and my late mother, Attalia Mabhena who always believed in me. My husband Bekezela who always rendered a listening ear and was always there holding my figurative hand all the way making sure that all was well with me. My daughters, Sinokubekezela and Nozithelo, I don't have enough words to thank you. I would like to also extend my gratitude to Mbongeni, my only sibling, Sichelesile, and everyone who helped emotionally, financially and spiritually. To my employer, NUST HOD Dr. T.V Nyathi, and to my workmates, I really appreciate your support.

Last, but not least, I extend my acknowledgement and gratitude to the Department of Information Systems at the University of Cape Town, specifically my supervisor, Prof Elsje Scott, for patiently walking me through this journey, sharing her wisdom and devoting her time and effort to guiding me in the right direction. Not forgetting Prof Ojelanki Ngwenyama and all the staff members in the department, I sincerely thank you for the different roles you played in encouraging me not to give up. I appreciate the kind words of encouragement that you provided me with during this journey.

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List of Acronyms

ACRONYM	DEFINITION
ANT	Actor Network Theory
AVU	African Virtual University
BYOD	Bring Your Own Device
CHAT	Cultural-Historical Activity Theory
CISCO	Commercial and Industrial Security Corporation
CLD	Causal Loop Diagram
COVID 19	Corona Virus Diseases 2019
CRT	Cathode Ray Tube
DOI	Diffusion of Innovation
EASSY	Eastern Africa Submarine Cable System
e-books	Electronic Books
EJISDC	Electronic Journal of Information Systems in Developing Countries
e-journals	Electronic Journals
e-learning	Electronic Learning
e-resources	Electronic Resources
ERP	Enterprise Resource Planning
f2f	Face to Face
GDP	Gross Domestic Product
HEI	Higher Education Institution
IBM	International Business Machines
ICT	Information and Communication Technology
ICT4D	Information and Communication Technologies for Development
IEARN	International Education and Resource Network
INFORMS	Information Systems Research
ITU	International Telecommunications Union
JAIS	Association of Information Systems
JICA	Japanese International Co-operation Agency
KMS	Knowledge Management Systems

LAN	Local Area Network
LMS	Learning Management System
MISQ	Management Information Systems Quarterly
MOOC	Massive Online Open Course
MOODLE	Modular Object-Oriented Dynamic Learning Environment
MS	Microsoft
MTN	Mobile Telephone Networks
NITDA	National Information Technology Development Agency
NRENs	National Research and Education Networks
NTIA	National Telecommunications and Information Administration
NUST	National University of Science and Technology
OSI	Open Systems Interconnectivity
OSISA	Open Society Initiative for Southern Africa
OSS	Open Source Software
PC	Personal Computer
RAT	Resource Appropriation Theory
RCIP	Regional Communications Infrastructure Program
REN	Research and Education Network
SME	Small to Medium Enterprises
ST	Structuration Theory
STEM	Science, Technology, Engineering and Mathematics
STEP-B	Science and Technology Education Post-Basic Project
TAM	Technology Acceptance Model
TETfund	Tertiary Education Trust Fund
TOE	Technology Organisation and Environment
WI-FI	Wireless Fidelity

Chapter 1: Research Problem and Study Rationale

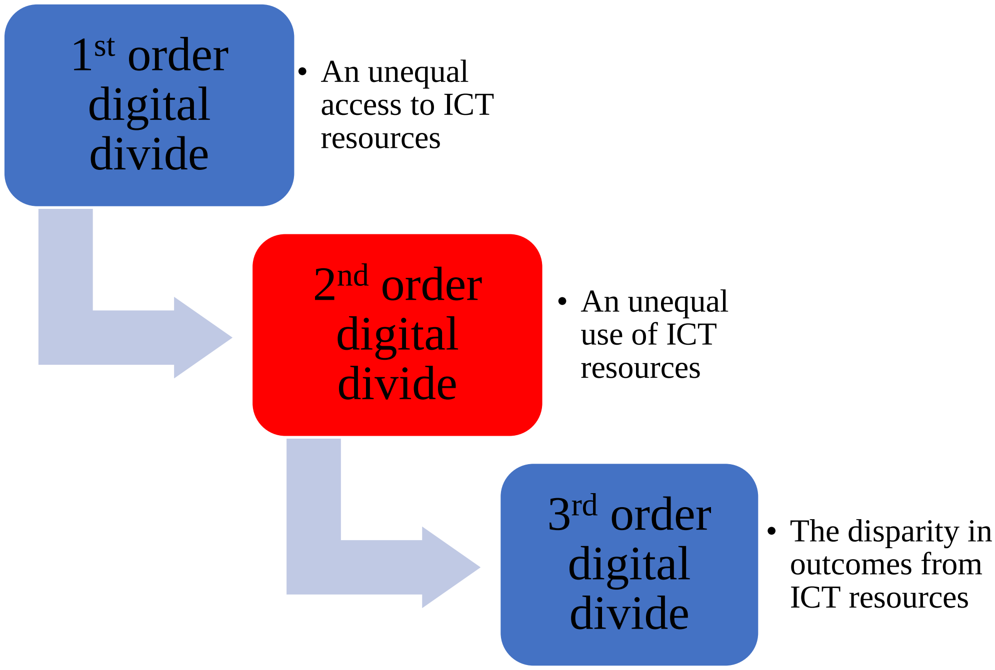
1.1 Introduction

Higher education institutions (HEIs) are knowledge production institutions whose core activities are teaching, learning and research. Literature further shows that HEIs provide a platform for higher education, which is the gateway to development (Zhu & Chen, 2013; Sarwade, Jadhav & Gade, 2014). In this digital age, the performance of those core activities can be improved and enhanced through the use of Information and Communication Technologies (ICTs) (Gasaymeh, 2018). This study adopts the definition from Russell and Steele (2013) that ICTs are technological tools, and resources that can be used to create, capture, store, transmit, share or exchange information. The educational affordances of ICTs which are documented in the literature include, but are not limited to, learning flexibility, improved communication, fast access to digital content and timeous feedback (Henderson, Selwyn, & Aston, 2017; Dzidonu, 2010; Cabero, Llorente, & Morales, 2013).

Given these education affordances of ICTs, which are well documented in the literature, it is a paradox that HEIs, particularly in developing countries, have not fully adopted ICTs as educational tools (Kisanjara, Tossy, Sife, & Msanjila, 2019; Njenga, 2018). Although the digital divide is a global phenomenon of concern, it is intensely experienced in the states with a low Gross Domestic Product (GDP) per capita a measure of the country's annual income against its population (United Nations, 2015; World Bank, 2020).

The global digital divide constitutes the first (1st), second (2nd), and third (3rd) order/level digital divide, such that the 1st order precedes the 2nd order and in turn the 2nd order precedes the 3rd order digital divide as is depicted in Figure 1.1. The 2nd order digital divide, which is characterised by an unequal usage of ICTs, is however, the most prominent problem of focus for this study since the 1st order digital divide, a gap in the access of ICTs is reducing (Nantongo & Hetland, 2020; Cariolle, 2020; Nyahodza & Higgs, 2017).

Figure 1.1 *The Progressive Stages of the Digital Divide*



Although, this second order digital divide is not a new research phenomenon, there is limited literature that undertakes to explain its emergence in HEIs (Nikolaos, Tzafea, & Theodoros, 2019). This chapter therefore begins with a section on the research background in order to introduce the context of this thesis. This is followed by a statement of the problem; the research aims and the research questions. The next section justifies the rationale for the study and the chapter concludes with an overview of the structure of this thesis.

1.2 Background of the Study

Within our current information rich, digital society, ICTs have become an integral aspect of higher education. ICTs have transformed traditional Face to Face (f2f) education through the implementation of learning paradigms like electronic, mobile, blended and cloud learning. Electronic learning (e-learning) is being facilitated by Learning Management Systems (LMS), which are currently the most popular platforms for hosting online courses. These e-learning platforms are available either as free open source systems like Sakai (Sakai 19.0 Release, 2019), or as proprietary systems like Blackboard Learn (Blackboard Inc, 2019). Many web-based LMSs are managed in-house; however, there are exceptions such as Google Classroom, which is a cloud-based system and is available for free to institutions whose electronic mail is registered on the Google domain (Sudarsana, Putra, Astawa, & Yogantara, 2019; Soon & Kadir, 2017). The Massive Open Online Course (MOOC) is currently the most popular and modern online course, particularly for distance learners (Haber, 2014). Given the existence of these ICT resources this thesis investigates the interlocking dynamics of the adoption of ICTs in the HEI context of Zimbabwe, a developing country in Southern Africa.

1.3 Contextual Background

The context of this research is Zimbabwe, a developing country in Southern Africa. Ongoing ICT implementation in educational institutions was spear-headed by the country's former president, Robert Mugabe, in 2010 (Kabanda, 2013). Despite the economic challenges faced by the country (African Development Bank, 2011), which have negatively affected ICT infrastructure development (ITU, 2017), Zimbabwe has made remarkable progress with regard to ICT adoption initiatives within the education sector. These developments have been necessitated by the development of the national ICT policy (FreedomHouse, 2018; Njaya & Murangwa, 2017; Chitiyo & Harmon, 2009).

However, literature reports that to date the ICT adoption level in HEIs within Zimbabwe is very low (Govender & Chitanana, 2016; Khumalo & Baloyi, 2018). This underutilisation of ICTs has resulted in a problem referred to in the literature as the digital divide, which is defined as an unequal access to, use of and outcomes from ICTs (Scheerder et al., 2017; Bellini, Isoni Filho, de Moura Junior, & Pereira, 2016). Based on this definition, the digital divide is regarded as having three elements: First (1^{st}) order relates to inequality of access, the Second (2^{nd}) order relates to inequality of use, and the Third (3^{rd}) order relates to inequality of outcomes from the implementation of ICTs.

Although all three elements are important research topics, studies provide evidence that the 1^{st} order digital divide is gradually closing due to increased ICT access following their reductions in cost (Wei & Hindman, 2011). This implies that the 1^{st} order digital divide is no longer a problematic phenomenon in either developed or developing countries. Research attention has therefore shifted from the 1^{st} to the 2^{nd} and 3^{rd} order digital divide (van Deursen & van Dijk, 2014; Scheerder, et al., 2017). Based on this perspective, the current research focuses on the 2^{nd} order digital divide in the HEI of a developing country, where the problem of ICT use is widespread as explained in the following section.

1.4 Problem Statement

In the previous section, the 2^{nd} order digital divide was identified as the primary concern of this research. This focus was informed by recent literature, which shows that while no country claims to have achieved inclusive country-wide access to ICTs (Sanders & George, 2017), many studies are focussed on the closing 1^{st} order digital divide (Soomro, Kale, Curtis, Akcaoglu, & Bernstein, 2020; Wei & Hindman, 2011). Recent studies have therefore emphasised a shift in research attention towards the 2^{nd} order digital divide (van Deursen & van Dijk, 2014; Scheerder et al., 2017).

Many existing studies on the topic of the 2^{nd} order digital divide are biased towards the context of developed countries (Friederici, Ojanperä, & Graham, 2017; Bornman, 2016; Venkatesh & Sykes, 2013; Haight et al., 2014). For this reason it was considered appropriate for the current study to focus on the 2^{nd} order digital divide phenomenon in the context of a developing country, particularly since literature shows that the digital divide is more prominent in developing countries (Nantongo & Hetland, 2020; Cariolle, 2020; Nyahodza & Higgs, 2017). In addition, there is limited literature investigating the causes of the 2^{nd} order digital divide, which has become a significant problem for HEIs in developing countries, since until now the research focus on developing countries has been primarily on the 1st order digital divide (Bellini, et al., 2016; Nantongo & Hetland, 2020).

The few attempts that have been made to explain the causes of the 2nd order digital divide are limited to sociodemographic, sociocultural and socioeconomic factors (Scheerder, Deursen, et al., 2017; Njenga, 2018). However, the persistence of the 2nd order digital divide has led researchers to believe that this digital divide is linked to hidden structures beyond the obvious factors (Henderson et al., 2015; Zewge & Dittrich, 2017). A recent study by Niyigena, Jiang, Ziou, & Shaw (2020) shows that existing literature acknowledges that the complex topic of digital divide requires an understanding of structures that underlie it. These structures could provide a better explanation of the 2nd order digital divide problem in the HEI of a developing country.

Although literature refers to inherent structures, the major problem is that there is limited literature that explicitly identifies and explains these structures contributing to the 2nd order digital divide. This literature gap is even wider in relation to HEIs within the context of a developing country. For this reason, Henderson et al. (2015) emphasised the importance of identifying and explaining such inherent structures while Várallyai, Herdon, and Botos (2015) observe that the 2nd order digital divide phenomenon is posing a major challenge to the policy-makers and academic researchers. Nikolaos et al. (2019, p. 60) concludes that “bridging of the digital divide has to be a priority for policies in order to implement new digital teaching and learning processes at all levels of education”. It is with this background in mind that the following section presents the aim of this study, which is to identify the structures leading to the 2nd order digital divide in the HEI of a developing country.

1.5 Research Aim

As was mentioned in the previous section, there is limited research reporting on structures that contribute to the 2nd order digital divide in HEIs in developing countries. The main goal of this research is thus to identify and explain the structures giving rise to the 2nd order digital divide in the HEI of a developing country. The objectives are firstly to identify the interlocking dynamics of ICT adoption and the structures behind the 2nd order digital divide and secondly, to suggest interventions for reducing the 2nd order digital divide in the HEI of a developing country. For this purpose, this study set out to answer the two questions detailed below.

1.6 Research Questions

It was important to describe what a structure is prior to asking the underlying questions. Generally, a structure refers to an orderly arrangement, which essential for performing a particular function. A structure can be physical (that is visible and/or tangible), for example buildings, vehicles, ICT hardware and infrastructure. A structure can also be abstract (such as related concepts, theories, or ideas). On this note, Archer (2010) refers to material structures like land while Giddens (1984) focus on virtual structures such as rules. This study investigates both the underlying physical and abstract structures leading to the 2nd order digital divide in HEIs. In order to identify and explain these structures (which is the aim of this research) it was necessary to answer the following two key questions.

RQ1: ***What structures lead to the 2nd order digital divide in HEIs of a developing country context?***

An answer to this question is imperative because there is insufficient research that has been aimed at conceptualising the 2nd order digital divide from the view of structures (Scheerder et al., 2017). Instead, it is argued in the literature that this digital divide is a dynamic and complex phenomenon (van Dijk & Hacker, 2000) that has been neglected for too long (Oh & Kathuria, 2010) and that demands research attention (Wei & Hindman, 2011). Increasing attention is now being drawn to the need for research to consider the structures that contribute to this problematic 2nd order digital divide (Várallyai, Herdon, & Botos, 2015; Scheerder, Deursen, et al., 2017; Njenga, 2018). For example, Nikolaos et al. (2019, p.63) argue that "a growing body of research seeks to explore the reasons that cause the increasing presence of digital divide in education”. This implies that an answer to this first question would benefit the research community by providing an insightful explanation for the problem of inherent structures in HEIs, that befits the specific context of the developing countries (Brown, 2016; Robinson et al., 2015; Baelden & van Audenhove, 2015). Closely linked to this is the following question regarding strategies for reducing this 2nd order digital divide.

RQ2: ***How can the 2nd order digital divide be reduced at HEIs of a developing country context?***

An answer to this question is long overdue because of the urgent need to address the widening 2nd order digital divide in the HEIs (Selwyn, 2010). For example, Robinson et al. (2015) report that the digital divide researchers are desperately seeking ways to reduce the 2nd order digital divide problem. while Várallyai, Herdon, and Botos (2015) argue that a solution to the 2nd order digital divide would benefit both policy-makers and academic researchers. A recent study by Nikolaos et al. (2019, p. 60) concludes that “the bridging of the digital divide has to be a priority for policies in order to implement new digital teaching and learning processes at all levels of education”. It can therefore be concluded that answers to these two research questions are fundamental to an understanding of the underlying structures leading to the 2nd order digital divide and to providing appropriate interventions for reducing the problem. Together, the answers to these questions will make a useful contribution to the body of knowledge as is evident in the following section.

1.7 Study Rationale

There were three major reasons for conducting this study. The first was derived from literature, which shows that limited empirical research has been conducted on the concept of the digital divide within the context of developing countries (Soomro, Kale, Curtis, Akcaoglu, & Bernstein, 2020; Peña-López, 2010). This was despite the growing realisation that developing countries are the most affected by the digital divide problem (Soomro et al., 2020; Venkatesh & Sykes, 2013).

The second reason for conducting this study relates to the limited theoretical grounding of research related to the digital divide (van Dijk, 2006; Scheerder, et al., 2017). Empirical findings based on research conducted in developing countries would provide an important opportunity to address this gap. For example, Avgerou, Hayes, and Le`bre La Rovere (2016) emphasise the need for the development of theories that are specific to the developing country context.

The final reason was the need to identify and understand structural causes contributing to the 2nd order digital divide, which is particularly necessary in HEIs in developing countries (Muyinda, Mayende, Maiga, & Oyo, 2019). HEIs in this context are faced with many challenges, such as shortages of both educational equipment and educators (Sanga, Magesa, Chingonikaya, & Kayunze, 2013; Hosman & Armey, 2017). The implementation of appropriate interventions could overcome barriers presented by inherent structures, thus facilitating the successful adoption of ICTs, and alleviating some of the problems facing HEIs within developing countries – particularly since the emergence of the novel coronavirus COVID-19, which is highly contagious and has created a global pandemic that demands social distancing education practices. The success of this research hinged on the adopted theory and data collection methods.

1.8 Research Theory and Data Collection Methods

This explanatory study investigated and attempted to explain the structures leading to the 2nd order digital divide in the HEI of a developing country. Achieving this purpose required the adoption of a theory that affords the uncovering of both the interlocking dynamics of ICT adoption and the underlying structures leading to the 2nd order digital divide. Structuration Theory emerged as an appropriate vehicle for this purpose, as it demonstrates how structures are produced by human actions, which are also enabled or constrained by those produced structures (Giddens, 1984). Furthermore, Structuration Theory would be a suitable sensitising tool for identifying the hidden structures that lead to the 2nd order digital divide (Orlikowski, 2000). Structuration Theory is also methodologically rich (Pozzebon & Pinsonneault, 2005), which befits the collection, analysis and interpretation of the empirical data.

This research followed the interpretive philosophy, which was vital for providing an understanding of meanings that are socially constructed by human beings during the process of producing and interacting with social structures (Walsham, 2006). In this study, the relevant meanings were extracted from data provided by a purposive sample of participants drawn from a single HEI case who participated actively in the sense-making about the phenomenon under study (Saunders, Lewis, & Thornhill, 2019). Data for this study was collected through semi-structured interviews with chairmen, lecturers, and technicians, focus group discussions with students, analysis of institutional documents and participant observations of practises of the HEI case. The study's empirical data resulted in insightful findings for explaining the structures leading to the 2nd order digital divide in the HEI case.

1.9 Structure of the Thesis

This thesis is divided into nine chapters, which are as follows: **Chapter 1** presents the circumstances, which led to the main research questions being asked. **Chapter 2** reports on findings from a literature review on ICT access and usage levels and introduces the digital divide problem in HEIs in developing countries. **Chapter 3** presents results from a systematic literature review involving documented explanations of the 2nd order digital divide and highlights the gap in the literature to be addressed by this study. **Chapter 4** presents Structuration Theory as an appropriate theory for guiding the data collection, analysis, and interpretation of findings from the empirical data. **Chapter 5** details the collection of rich data from a purposive sample of participants situated at a single HEI in Zimbabwe. **Chapter 6** outlines the preliminary findings emerging from a directed content analysis approach, while **Chapter 7** discusses the emergent themes and the structures manifest in those themes. **Chapter 8** presents a theoretical elaboration of the interlocking dynamics of ICT adoption and explains their implications for theory and practice. Finally, **Chapter 9** summarises the achievements of this research process its limitations and suggestions for future work.

Chapter 2: ICTs in HEIs and the Digital Divide

2.1 Introduction

The previous chapter demonstrated that the digital divide is a problematic phenomenon, which concerns researchers and policy-makers (Várallyai, Herdon, & Botos, 2015; Selwyn, 2006; Nikolaos et al., 2019). Although the term “digital divide” was usually used to describe differences in ICT haves and have nots, its use has been expanded to include the inequalities in the use of and outcomes from ICTs. It is on this note that literature discusses it in relation to the first, second and third order digital divide, concerning access to, use of and outcomes from ICTs (Scheerder et al., 2017). Digital divide is usually analysed based on such factors as age, gender, ethnicity, education, income, and geography.

The persistence of this global inequality problem has prompted researchers like (van Dijk, 2002) to theorise the process of appropriating ICTs (digital technologies) based on what they refer to as the motivation, physical, skills and usage access as is shown in Figure 2.1.

Figure 2.1 *Stages of ICT Appropriation Adapted from* van Dijk (2002)

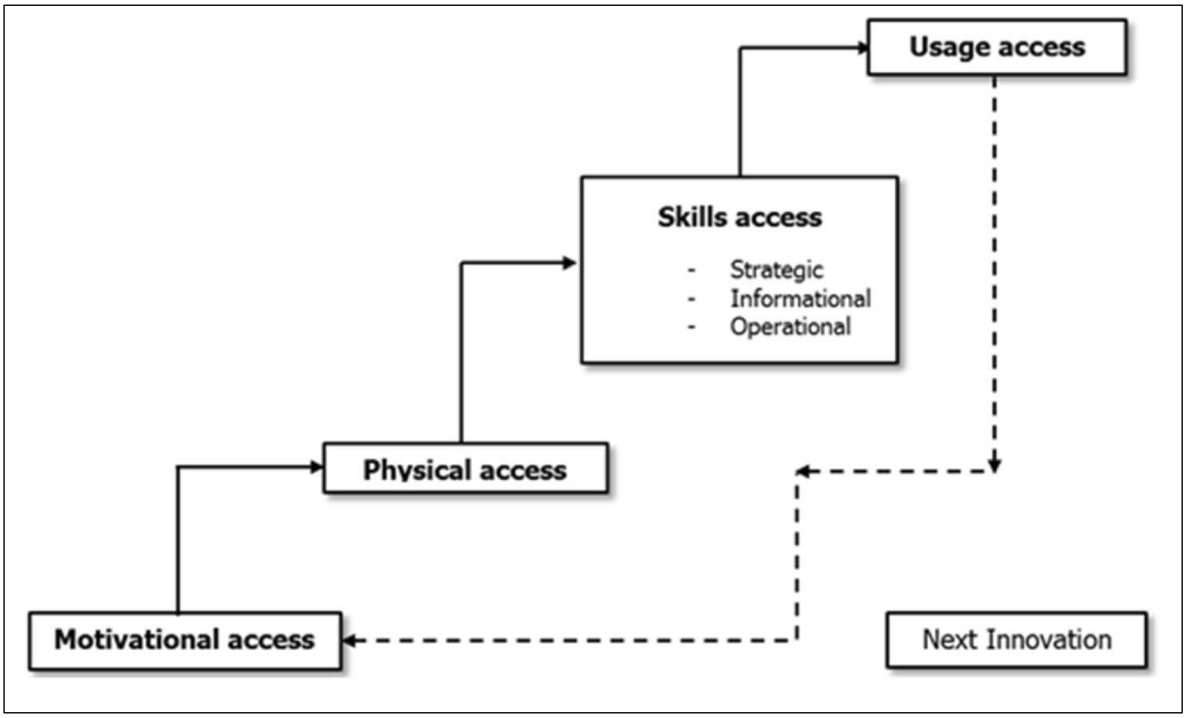


Figure 2.1 shows four successive ways of appropriating an ICT resource. The process begins with a motivation (an interest in an ICT), followed by physical access (the possession of an ICT), then skills access (the capacity to utilise an ICT) and finally usage access (the actual interaction with the ICT). A gap between any two of these four ways of ICT access results in what literature terms the "digital divide", such that a gap in motivation and/or physical access leads to the first order digital divide while a gap in skills and/or usage results in a second order digital divide. The review of literature shows that "this gap exists on multiple levels, whether between individuals, small segments within a population, countries, or global regions", (Russell & Steele, 2013, p. 2).

Despite that existing literature acknowledges that the digital divide is a global phenomenon, the digital divide appears to be more prominent in developing countries than in other regions (Russell & Steele, 2013; Nantongo & Hetland, 2020). It was with this mindset that this chapter reports on the findings from a literature review regarding the ICTs in HEIs, followed by a section on the benefits and challenges of using ICTs in HEIs. The report continues to highlight the levels of access and usage of ICTs in HEIs within developing countries. The next section introduces the concept of digital divide, defined as the gap in access to, usage of and outcomes from ICTs. The final section of this chapter provides an overview of the 2nd order digital divide, paving the way for a systematic literature review on its causes, which is detailed in Chapter 3.

2.2 ICTs in HEIs

A clear understanding of ICTs was fundamental to the explanation of the concept of the digital divide. This is informed by Robinson et al. (2015) who argue that an understanding of the digital divide depends on a consideration of the circumstances surrounding access to and use of ICTs. The term ICTs is used in the literature to refer to technologies for input, processing, output and storage of digital information (Hubackova & Klimova, 2014). ICTs include but are not limited to ubiquitous devices, social media, and emerging technologies. In this thesis, ICTs refer to computing devices and related technologies that support life-long learning such as e-learning, mobile learning, blended learning, and cloud learning. Literature show that such learning is facilitated by ICT resources like desktop computers, mobile devices, social media networks, library web sites, electronic resources, LMSs, interactive whiteboards, Google tools, Wikipedia, web portals and MOOCs (Henderson, Selwyn, Finger, & Aston, 2015; Garavaglia & Petti, 2015). Successful adoption of these ICT resources by educational institutions is associated with both benefits and challenges some of which are presented in the following sections.

2.2.1 Educational Benefits of ICTs

Several studies have documented the benefits of ICTs in teaching, learning and research, which are the core education activities of HEIs. A sample of these benefits is depicted in Figure 2.2; they include providing learners with a flexible learning environment, affording learners instant feedback and motivating learners to actively participate in an exciting learning process (Rudhumbu, 2020). More benefits of ICTs in learning include presenting learners with an opportunity to personalise their learning, and to learn by discovery, experimentation and collaboration (Soomro et al., 2020; Sebbowa & Muyinda, 2018; Henderson et al., 2017).

Nantongo and Hetland (2020) refer to benefits of ICTs in teaching such as faster production and delivery of course content, easy monitoring of students' progress, rapid task distribution and more efficient methods of evaluating and grading students' performance. ICTs also benefit research because they can be used to publish research output, increase research visibility and provide a flexible platform for presenting research output (Gwamba, Renken, Nampijja, Mayende, & Muyinda, 2017; Muyinda et al., 2019).

Figure 2.2 *The Main Benefits of ICTs in Education*

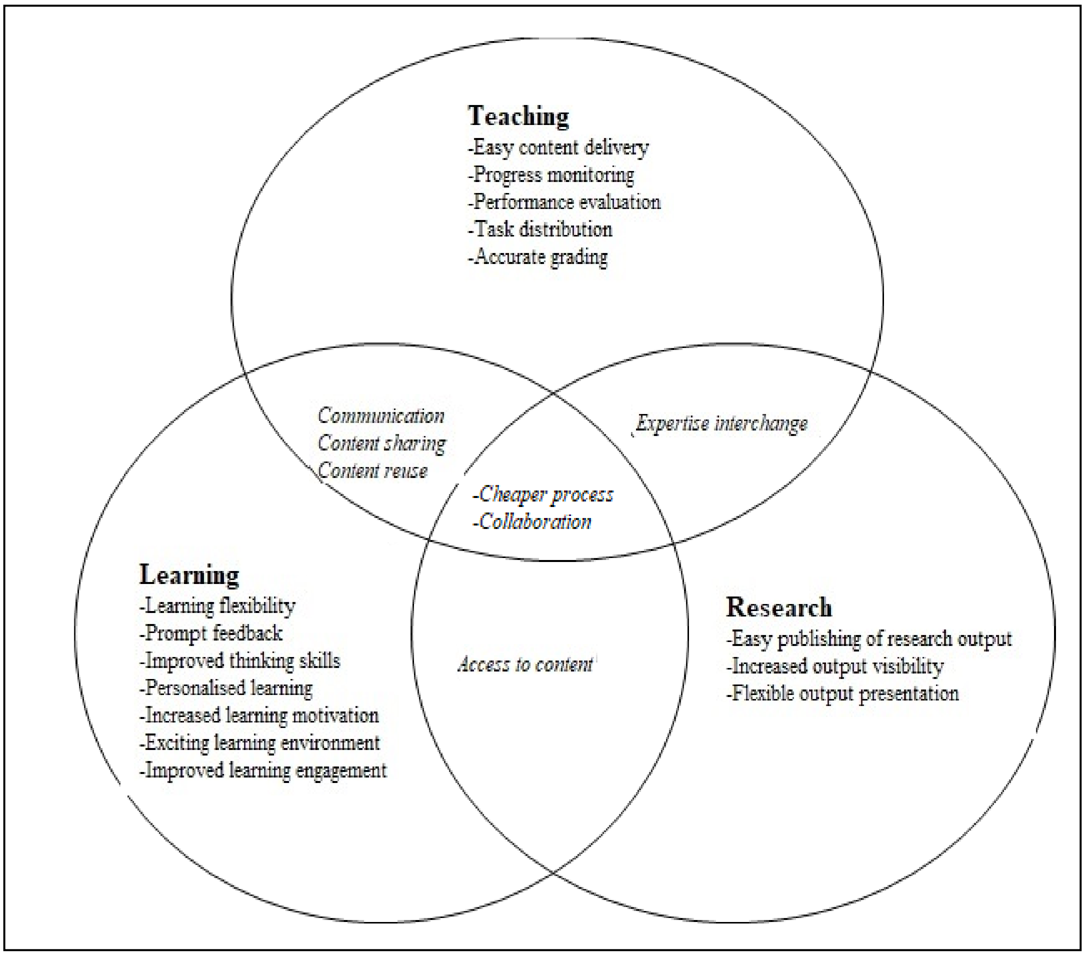


Figure 2.2 shows that there is an overlap of ICT benefits such as cheaper process of accessing educational content and collaboration between learning, teaching and research as well as expertise interaction, between research and teaching. Access to content between research and learning, as well as communication, content reuse and content sharing between teaching and learning. Despite their benefits, ICTs present education challenges as is evident in the next section.

2.2.2 Educational Challenges of ICTs

Several challenges of ICTs in education are also documented in the literature. Figure 2.3 presents a sample of challenges in teaching, learning and research, the core education activities.

Figure 2.3 *The Main Challenges of ICTs in Education*

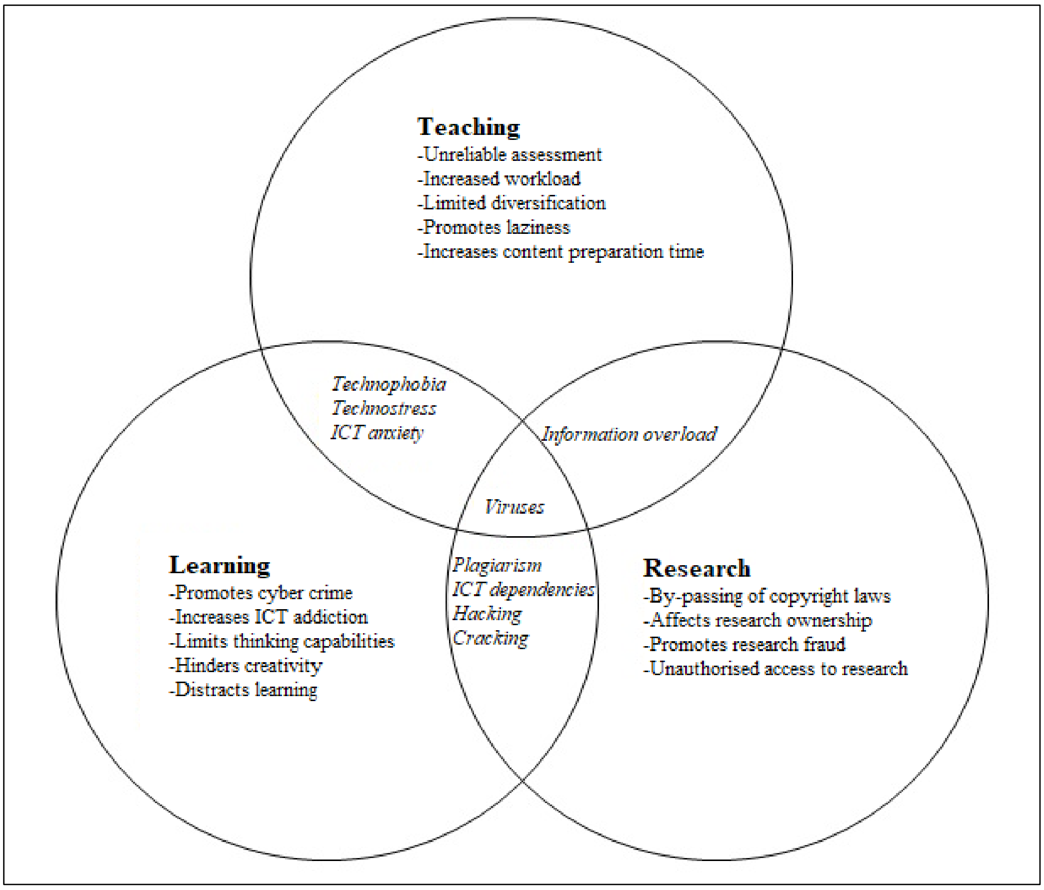


Figure 2.3 shows that the integration of ICTs in teaching has been associated with laziness, poor teaching skills and an increased workload (Nantongo & Hetland, 2020; Nikolaos et al., 2019). ICTs can also reduce creativity and diversification (Mikre, 2011). Numerous researchers, such as Bellini et al. (2016) as well as Ransbotham, Fichman, Gopal, and Gupta (2016) propose that the improper use of ICTs violates learning ethics. For example, Sanders and George (2017) report on the abuse of tablet PCs by learners in some South African schools who used those ICTs for illicit activities. Students' leaning may be disrupted when they are not closely monitored and use their mobile devices to chat, play games, watch movies, or listen to music during class (Sebbowa & Muyinda, 2018). This emphasises the importance of monitoring the students' use of ICTs in the classroom to avoid unacknowledged use of ICTs.

In the research context, ICTs can be used as tools downloading or copying intellectual property without acknowledgement, and thus committing plagiarism. Mikre (2011) and Brown (2016) identify dependency syndrome as a challenge of using ICTs in research. ICT challenges that are common among all three education activities relate to a loss of information due to computer viruses (Mikre, 2011; Brown, 2016). Students and researchers are both negatively affected by ICTs that present opportunities for plagiarism, dependency syndrome, cracking and hacking.

After conducting a comparison of the educational benefits and challenges arising from the use of ICTs, Kisanjara et al. (2019) and Nikolaos et al. (2019) argue that the educational benefits from ICTs outweigh the challenges. The existing literature therefore shows that this wealth of potential benefits of ICTs in education should be used to promote the education activities of the modern HEIs (Nantongo & Hetland, 2020; Khumalo & Baloyi, 2018). Motivated by this observation, I was prompted to conduct an evaluation of the levels of access and usage of ICTs in HEIs within developing countries.

2.3 ICT Access Levels within HEIs of Developing Countries

The previous sections provided an insight into the benefits and challenges of ICT-supported education. This section explores the levels of access to ICTs in HEIs within developing countries. For this purpose, it was imperative to begin by differentiating developed from developing countries. A developed country is a sovereign state with a developed economy and technologically advanced infrastructure compared to other nations. Several factors determine whether or not a country is developed, such as the Human Development Index, political stability, gross domestic product (GDP), industrialization, and freedom. Countries that are not quite yet developed are called developing countries.

In this study, the researcher employed the GDP per capita as the metric for identifying the developing countries (see Appendix A). GDP per capita is the measure of the country's annual income against its population. In this sense. the (World Bank, 2020) reports a low GDP per capita of US$1390.00 for Zimbabwe and a high GDP per capita of US$85500.00 for Switzerland.

Based on these GDP per capita, it could be concluded that Zimbabwe is a developing country while Switzerland is a developed country. Zimbabwe share a similar GDP per capita with such African countries as Ghana, India, Nigeria, Kenya, Pakistan, and Zambia (see Appendix Y), which justifies the inclusion of such countries in the review of literature. Although, the neighbouring South Africa, Botswana and Namibia have a higher GDP per capita ranking than Zimbabwe, the empirical studies conducted in these countries were included in the reviewed literature since they share the borders with Zimbabwe, the context of focus for this study, as is indicated in a map in Figure 5.2.

It has been observed in the literature that ICT access levels have been increasing globally (Avgerou et al., 2016). For example, Selwyn and Facer (2014, p. 283) observe that “classrooms and other formal learning environments are now awash with computer hardware and software”. Similarly, Venkatesh, Croteau, and Rabah (2014, p. 111) acknowledge that a “burgeoning integration of ICTs in higher education has reached a tipping point”. Henderson et al. (2015, p. 308) conclude that ICTs are now “woven deeply into the fabric of university teaching and learning”.

HEIs in developing countries are also included in these ICT developments (Nantongo & Hetland, 2020; Niyigena, Jiang, Ziou, & Shaw, 2020; Bezuidenhout et al., 2017; Njenga et al., 2010). Brotcorne et al. (2010), Mohamed et al. (2012), Friederici et al., 2017) and others have ascertained that an increase in ICT access in HEI within developing countries has been attributed to initiatives involving government, HEI themselves, private companies, and individuals.

2.3.1 Government Level ICT Access Initiatives

The governments of developing countries have been commended for spearheading ICT access strategies involving ICT budgets, ICT policy formulation and ICT cost subsidies (Muyinda et al., 2019; Friederici et al., 2017; Rana, Greenwood, & Fox-Turnbull, 2020). For example, Ruhode (2016) reveals that Zimbabwe has a stand-alone Ministry of ICT, which has facilitated the development national of ICT policy. Literature reports that the national ICT policy of Zimbabwe was launched by the state's president in March 2018 included the guidelines for connecting to the Internet (Freedom House, 2018).

Avgerou et al. (2016, p. 320) acknowledge that "Almost all governments in developing countries have ongoing information systems projects aiming at efficiency of administration and improvement of public sector services". Governments in Pakistan, Gambia, Namibia, and Rwanda have implemented government-funded projects for the acquisition of ICT infrastructure to support education activities. For example, the Ugandan government developed an ICT policy that has promoted ICT-supported education (Muyinda et al., 2019)lecturers in Pakistan universities are reported to have access to basic ICTs like desktop computers due to the government inanities (Soomro et al., 2020).

The Nigerian government acquired desktop computers and implemented websites and portals for education use by the HEIs' communities (Olelewe & Okwor, 2017; Kabir & Kadage, 2017). Montiel (2016) reported that the Mexican government had installed a fibre optic-based network for use in the country's HEIs; while in Brazil, the government funded a project for setting up and equipping computer laboratories at HEIs (Bellini et al., 2016). Wondwosen (2020) reports on government access initiatives in Ethiopia, which included the formulation of a national ICT policy, privatisation of the Telecommunications sector, development of digital skills and ICT infrastructure. Similar efforts have been reported that involved the Indian government, which has availed laptops to the less privileged students for use in their learning (Talikoti, 2020)

The Zimbabwean governments have both introduced e-learning to support education activities (Dube & Scott, 2017c) and developed a national ICT policy aimed at supporting the ICTs in education (Njaya & Murangwa, 2017; Chitiyo & Harmon, 2009).

These few examples provide evidence of the involvement of developing countries' governments in increasing access to ICTs for supporting their education initiatives. Additional ICT access initiatives have been undertaken by specific HEIs.

2.3.2 HEI Level ICT Access Initiatives

HEIs in developing countries have made significant contributions towards increasing ICT access levels (Muyinda et al., 2019). These HEIs have facilitated access to basic ICTs such as desktop computers, printers, interactive whiteboards, projectors, LMS systems, Electronic Books (e-books) and Electronic Journals (e-journals). For example, South Africa HEIs, policy-makers implemented ICT and Bring Your Own Device (BYOD) policies to facilitate use of ICTs in education (Brown & Czerniewicz, 2010; Ng'ambi, Brown, Bozalek, Gachago, & Wood, 2016). Similar policies have also been implemented in other developing countries like Nigeria and Tanzania (Mtebe, 2015; Sanga et al., 2013). The management of Makerere University in Uganda facilitated the implementation of an E-learning Management System to support higher education (Gwamba et al., 2017).

Literature reports that the management of HEIs in Zimbabwe have contributed to the set-up of campus-wide computer network for use in teaching, learning and research (Chitiyo & Harmon, 2009; Ruhode, 2016). Similarly, Chaputula (2012) observes that the management of Mzuzu University in Malawi used the institutional funds to provide Internet connectivity via a wireless Local Area Network (LAN). The management of several HEIs has implemented free and open source LMSs like Modular Object-Oriented Dynamic Learning Environment (MOODLE) and Sakai to host online courses and facilitate e-learning (Njenga, 2018). A sample of such developing countries that have initiated online learning is listed in Table 2.1.

Table 2.1 *GDP Rank for Selected Developing Countries Adopted from* (World Bank, 2020)

World Bank GDP Rank	Country	GDP per capita ranking (USD)
82	Botswana	7,660
96	South Africa	6,000
145	India	2,130
147	Nigeria	2,030
156	Pakistan	1,530
162	Zimbabwe	1,390
167	Nepal	1,090
168	Tanzania	1,080
173	Ethiopia	850
178	Uganda	780
191	Malawi	380

Additional ICT access initiatives in HEIs that are attributed to private companies or agencies, are discussed below.

2.3.3 Private Agencies' ICT Access Initiatives

Privately owned companies and non-governmental agencies have made a substantial contribution towards improving access to ICTs within HEIs by donating funds and equipment (Addy & Ofori-Booteng, 2015; Avgerou et al., 2016). For example, Non-governmental organisations have been instrumental in the facilitation of ICTs in Nepal's education (Rana et al., 2020). Olelewe and Okwor (2017, p. 172) shows that HEIs in Nigeria have benefitted from "efforts of major stakeholders such as Mobile Telephone Networks (MTN), Science and Technology Education Post-Basic Project (STEP-B), National Information Technology Development Agency (NITDA), Tertiary Education Trust Fund (TETfund) and Zinox computers in collaboration with Federal Ministry of Education".

HEIs have also benefited from the provision of ICTs supplied by the Open Society Initiative for Southern Africa (OSISA), Open Systems Interconnectivity (OSI), the World Bank EDRP Project, DOSSANI Trust and the Japanese International Co-operation Agency (JICA) (Chaputula, 2012). Some companies in the European Union countries donated funding to support a project involving a LAN network implementation at the University of Zimbabwe.

Increased accessibility to ICTs in HEIs within developing countries is also due to a project collaboration of the World Bank, Facebook and World Links, which aimed at improving Internet connectivity across Africa, Latin America, the Middle East and Asia (Mikre, 2011). ICT accessibility is also attributed to projects involving inter-country partnerships such as the Eastern Africa Submarine Cable System (EASSY) project. and the Global Internet connectivity (Cariolle, 2020). Other HEIs have increased access to ICTs due to ICT leapfrogging, a term that has been used over the years to describe the ICT advancement in developing countries. Through leapfrogging, HEIs within developing countries have made notable technological advancements as they adopt ICTs developed in other regions (UNCTAD, 2018; Kundi & Nawaz, 2014; Bezuidenhout et al., 2017). These initiatives are further complemented by the efforts of individual lecturers and students.

2.3.4 Individual Level ICT Access Initiatives

A significant reduction in the cost of ICTs has led to increased proliferation and permeation of computing devices like mobile phones (Gwamba et al., 2017; Avgerou et al., 2016) since the current generation of university students and lecturers can now afford ICT devices, which were previously associated only with the elite (Sebbowa & Muyinda, 2018). These low-cost ICTs include social media networks and handheld, light weight, ubiquitous, durable mobile devices with a longer battery life. Ng'ambi, et al. (2016) observed that social networking sites with educational capabilities are easily accessible to students enrolled in South African universities. On a similar note, Talikoti (2020) acknowledges that at Karnataka in India, both lecturers and students have invested in personal mobile devices, which the use for education purposes. also a significant ownership of smart phones by students was also evident at HEIs in countries like Zambia and Zimbabwe (Dube & Scott, 2017b; Saha & Zaman, 2017).

It is through such government, private sector, HEIs and individual ICT initiatives that HEIs in developing countries have achieved increased accessibility to ICTs (Calandro, Stork, & Gillwald, 2013; Olelewe and Okwor, 2017). It should however be noted that ICT accessibility is not an end in itself, since accessibility is closely linked to actual usage (Sagrista & Matbob, 2016; Helsper & Reisdorf, 2013). This implies that beyond access there is use, and ICT access is only beneficial if accompanied by effective usage (Britz et al., 2012; Quimno, Imran & Turner, 2013). It was therefore necessary to review ICT usage levels in HEIs within developing countries since a gap in ICT usage results in a 2nd order digital divide problem.

2.4 Usage Levels of ICTs in Higher Education

While the previous sections focussed on ICT access levels, this section discusses ICT usage levels in HEIs, as depicted in Table 2.2 which lists a sample of relevant studies on ICT usage. It is apparent from Table 2.2 that the adoption of ICTs in HEIs in developing countries is at an early stage as evident from their low usage levels when compared to counterparts in developed countries. ICT usage is used in this study to refer the actual level of engagement with ICTs and not necessarily the frequency or intensity of using ICTs.

Table 2.2 *A Regional View of ICT Usage Levels*

Study article	Observation
Gasaymeh (2018)	In this study *students' use of ICTs for learning is* low.
(Govender & Chitanana, 2016)	*Midlands State University lecturers are commended for advancing from technophobia to technological savviness.*
Gwamba et al. (2017)	The full utilisation of a LMS at Makerere university *is minimised by institutional factors.*
Khumalo and Baloyi (2018)	The full potential of *social media in education at NUST is yet to be realised.*
Kisanjara et al. (2019)	The *usage of e-learning* in Tanzania's universities needs improvement.
Muyinda, Mayende, Maiga and Oyo (2019)	*The utilisation of ICTs by lecturers in Uganda is limited by ICT resource availability.*
Nantongo and Hetland (2020)	The *educational uptake of ICTs in Sub-Saharan countries is narrow*.
Ng'ambi et al. (2016)	*Social media are not used* in South Africa's higher education.
Niyigena, Jiang, Ziou, & Shaw (2020)	The widely proliferated ICTs in HEIs in developing countries *are yet to be taken full advantage of.*
Rana et al. (2020)	The uptake of ICTs in education is improving, although *full utilisation is affected by limited ICT resources.*
Rudhumbu (2020)	*A full utilisation of ICTs in Zimbabwe's HEIs is hindered by limited ICT resources.*
Sanders and George (2017)	The study illustrates that ICTs are *used less for higher education.*
Soomro et al. (2020)	Lecturers in Pakistan universities have *high motivation to adopt and utilize ICTs in education.*

Table 2.3 compares ICT usage in HEIs of Zimbabwe, the context of this study and South Africa, a neighbouring country that is transitioning towards a developed status. It shows that HEIs in South Africa have been championing the utilisation of ICTs when compared to HEIs in Zimbabwe. For example, on one hand, Brown and Czerniewicz (2008) are of the opinion that HEIs in South Africa were integrating ICTs in education at as early as the year 2008. On the other hand, Khumalo and Baloyi (2018) claim that affordances of social media were yet to

be realised in the education of a HEI in Zimbabwe. These observations are confirmed by ITU (2017), which reports a notable gap in the ICT use ranking of South Africa and Zimbabwe. These findings revealed a gap in ICT usage in HEIs of these developing countries, which literature terms the "digital divide".

Table 2.3 *Comparison of South Africa and Zimbabwe' adoption of ICTs*

ICT use in South Africa's HEIs	ICT use in Zimbabwe's HEIs
Brown and Czerniewicz (2008) reveal *students' wide use of ICTs in their studies*.	Chitiyo and Harmon (2009) observe a *limited uptake of the Internet by lecturers.*
Paskevicius and Ng'ambi (2011) posit that *HEIs in have embraced emerging technologies in education practice.*	Zanamwe, et al. (2013) claim that *some universities' management are discouraging the educational use of Social media*
Brown and Pallitt (2014) report on *a one-to-one laptop initiative for the benefit of students at the University of Cape Town*.	Dube and Scott (2014) observe a slow *integration of the LMS tools in the education practice at NUST.*
Ng'ambi et al (2016) *reports on a notable move towards cloud-based ICT infrastructure with "unlimited" educational resources.*	Chitanana (2014) points to a narrow distribution *of e-learning systems in HEIs' education.*
Nyahodza and Higgs (2017) point to the *provision of unlimited Internet and e-services* at the University of Western Cape	Govender and Chitanana (2016) posit that *lecturers at a HEI in Zimbabwe have overcome technophobic tendencies.*
ITU (2017) reveals a positive ICT use index ranking of 95 for South Africa.	This ITU (2017) report depicts *a very low ICT use index ranking of 127 for Zimbabwe.*
Sanders and George (2017) report on the *successful roll-out Tablet PCs in schools across South Africa*.	Khumalo and Baloyi (2018) are of the opinion that *NUST is not fully exploiting the educational affordances of social media.*

2.5 The Digital Divide Phenomenon in HEIs

This section introduces the digital divide, a term that refers to the gaps in access to and use of ICT. Digital divide threatens the ICT "have-nots", whether individuals, groups or entire countries.". There is, however, a lack of consensus regarding the origin of the term 'digital divide' with regards to ICTs. Some scholars believe that the term 'digital divide' was first coined by the former U.S. President, Bill Clinton in 1994 to differentiate the Internet haves from the have-nots (Mohamed, Judi, Nor, and Yusof, 2012; Underwood; 2007). Other scholars like Cruz-Jesus, Vicente, Bacao, and Oliveira (2016) and Rye (2008) associate the term 'digital divide' with the third "Falling Through the Net" report, issued by the US Department of Commerce's National Telecommunications and Information Administration (NTIA), while yet other scholars maintain that the term 'digital divide' has unassigned origin (Gunkel, 2003). Robinson et al. (2003, p.3) conclude that this term "has spawned a great deal of policy and academic controversy".

Despite these differing opinions about its authorship, literature is in agreement regarding the definition of digital divide, which involves unequal access to, use of outcomes from using ICTs (Bornman, 2016; Scheerder, van Deursen, & van Dijk, 2017). This explains why Bellini et al. (2016) refer to the 1st 2nd and 3rd order digital divide in relation to unequal access to, use of and outcomes from ICTs, as summarised in Table 2.4.

Table 2.4 *Types of Digital Divide (Adapted from Selwyn, 2010)*

Digital divide	Stage	Meaning
1st order digital divide	ICT access	Unequal access to ICT hardware, software, and the network infrastructure.
2nd order digital divide	ICT usage	A gap in the levels and frequency of using ICTs in a meaningful, effective, and productive manner.
3rd order digital divide	ICT outcomes/ consequences	Differentiated results from using ICTs.

Bellini et al. (2016) observe a relationship between the 1st, 2nd and 3rd order digital divide such that ICT access precedes ICT use, and ICT use precedes the realisation of outcomes resulting from ICT use. Although the focus of this thesis was on the 2nd order digital divide, it was worth a brief discussion of the preceding 1st order digital divide since the 1st order digital divide paves the way for the 2nd order digital divide (Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008). It was thus apparent that any obstacle which limits access to, use of or outcomes from ICTs will result in a digital divide (Baelden & van Audenhove, 2015; Deursen & Andrade, 2018) as is discussed below.

2.5.1 The 1st Order Digital Divide in HEIs in Developing Countries

Várallyai, Herdon and Botos (2015) define the 1st order digital divide as a gap in access to ICTs. Literature shows that due to the reduction in cost of ICTs, access to ICTs has increased significantly, leading to the gradual closure of the 1st order digital divide (Wei & Hindman, 2011; van Deursen & van Dijk, 2014; Helsper & Reisdorf, 2013). Studies also show that even in HEIs in developing countries access to ICTs has increased sufficiently to result in a decrease in the 1st order digital divide (Vincent-Lancrin, et al., 2019). While this was a positive step, there are concerns in the literature that the reduction in the 1st order digital divide has led to the emergence of the 2nd order digital divide (van Dijk, 2012; Radovanovi et al., 2015). This reinforces the conclusion reached by Hohlfeld et al. (2008) that when one digital divide is overcome, another emerges. The narrowing of the 1st order digital divide thus explains the shift of research attention towards the 2nd order digital divide (Bornman, 2016; Brotcorne et al., 2010) as discussed in the following section.

2.5.2 The 2nd Order Digital Divide in HEIs in Developing Countries

Racherla and Mandviwalla (2013) argue that the importance of ICTs does not lie in their access but rather in their effective usage. Gunkel (2003) and Britz et al. (2012) argue that beyond ICT access, there exists a separate concern about the usage of those ICTs. Moreover, literature shows that an increase in ICT access does not necessarily translate to effective usage (Hsieh, Rai, & Keil, 2008; van Dijk & Hacker, 2003). Radovanovi et al. (2015) and Castaño-Muñoz (2010) argue that this principle applies to the closing of 1st order digital divide, which is not an end in itself but rather a threshold leading to the2nd order digital divide.

Numerous studies highlight the importance of understanding the 2nd order digital divide, which refers to a gap in ICT usage (van Deursen & Andrade, 2018). Although it is not a new research phenomenon, the 2nd order digital divide is so problematic that it has been attracting the recent interest of researchers (Scheerder et al., 2017; Abdollahyan, Semati, & Ahmadi, 2013; Selwyn & Facer, 2014). Table 2.5 depicts the global concerns about the 2nd order digital divide.

Table 2.5 *Concerns on the 2nd Order Digital Divide in Developing countries*

Context	Focus of study	Determinants of 2nd order digital divide
Bangladesh	Saha and Zaman (2017) analysed the digital divide among university students.	*Gender was implicated as the main source of the digital divide.*
India	Talikoti (2020) investigated the digital divide between lecturers and students of Karnataka in India.	*They attributed the closure of digital divide to the availability of ICTs*
Nigeria	Adeleke (2020) explored the digital divide relating to the Internet usage.	*Age, gender, electricity, were the major contributory factors of the digital divide.*
South Africa	Nyahodza and Higgs (2017) researched on the determinants of a gap in the use of e-resources at the university of Western Cape.	*They associated the gap with inaccessibility of the internet resources.*
Pakistan	Soomro et al. (2020) examined the digital inequalities regarding motivational, physical, skills and usage of educational ICTs.	*age, gender, and type of university* were contributing determinants of digital divide.
Zambia	Mukosa and Mweemba (2019) reviewed literature on E-learning based digital divide.	*Lack of resources was implicated in the digital divide.*
Zimbabwe	Dube and Scott (2017b) investigated the digital divide associated with students' use of digital technologies.	*The digital divide was attributed to gender and income.*

The contents of Table 2.5 are revealing in many of these studies in the literature review attribute the 2nd order digital divide to obvious factors affecting the use of ICTs such as age, gender, income, context, and ICT resource in availabilities. None of the reviewed literature explicitly related the 2nd order digital divide to inherent hidden structures. This observation accelerated the need to conduct a systematic review of literature to capture the underlying structures that are contributing to the 2nd order digital divide as it is experienced in HEIs within the context of developing countries.

2.6 Conclusion

This chapter began with an overview of ICTs in HEIs, with a particular focus on the educational benefits and challenges of using ICTs in HEIs and argued that the ICT benefits outweigh the challenges. This was followed by a review, regarding access and usage of ICTs in HEIs in developing countries, which were identified based on the GDP per capita. The next section introduced the concept of the digital divide, a gap in the access to, use of and outcomes from ICTs, corresponding to the 1st, 2nd, and 3rd order digital divide. It was emphasised in the concluding section that the focus of this study was the 2nd order digital divide since the 1st order digital divide was gradually closing while the 2nd order digital divide was widening. It was also argued in this chapter that while the 2nd order digital divide widening, the explanation of its causes was narrow as it was limited to common and obvious for adopting of ICTs.

While numerous studies have highlighted the need to explain the deeper structures behind the 2nd order digital divide, the existing explanations from a haphazard review of literature were inadequate for this purpose since they focussed much on superficial factors such as age, gender, ICT resource availability among other factors. None of the reviewed literature convincingly uncovered the underlying structures that could result in a better explanation of the 2nd order digital divide problem. It was with this mindset that the concluding remarks of this chapter emphasised the importance of conducting a systematic review of literature in order to identify the deeper structures behind the 2nd order digital divide in HEIs within developing countries. This paved the way for a detailed report on digital divide literature that has been conducted in HEIs of developing countries, which is presented in the next chapter.

Chapter 3: Causes of the 2nd Order Digital Divide in HEIs: A Systematic Literature Review

3.1 Introduction

The previous chapter introduced the concept of the digital divide, and explained how gaps in the access to, use of and outcomes from ICTs translate into the 1st, 2nd, and 3rd order digital divides, respectively. Results from a literature review revealed that many researchers have referred to ICT use factors leading to the 2nd order digital divide in HEIs within developing countries but have overlooked the potential contribution of inherent structures (Niyigena et al., 2020; Njenga, 2018; Avgerou et al., 2016; Njaya & Murangwa, 2017). This limitation motivated me to conduct a systematic review of literature focussing on the roles of ICTs and structures within HEIs in developing countries.

This chapter addresses apparent limitations in the literature by reporting results from a systematic review of literature involving the structures leading to the 2nd order digital divide in HEIs within developing countries. The first section of the chapter describes the systematic literature review process adopted in this study. This was followed by a section that reports on the findings of the reviewed literature. The following section details the implications of the findings from these empirical studies. The concluding section of the chapter highlights the gap in the literature regarding practice, theory, and methods.

3.2 The Systematic Literature Review Process

The systematic review strategy adopted in this study was proposed by Okoli and Schabram (2010) who identified eight steps involved in the literature review process. These steps include identifying the purpose of the literature review, defining the literature review protocol, conducting a search for literature, screening publications for relevance, conducting a quality appraisal, extracting relevant data, synthesising the findings, and writing the report.

In the first step, the *purpose of this systematic literature review* was to identify relevant empirical studies that attempt to explain the structures that contribute to the 2nd order digital divide in HEIs in developing countries. The second step, the *literature review protocol* was limited to studies that were written in English and published in the period from 2010 to 2019. The third step, the *search criteria for literature* involved the identification of relevant articles that had been published in highly rated scientific databases like ISI Web of Science, Scopus, EBSCO, ERIC ProQuest and Google Scholar. I was mainly interested in publications found in the top-rated Information Systems journals such as the Journal for the Association of Information Systems (JAIS), Management Information Systems Quarterly (MISQ) and Information Systems Research (INFORMS) or focus on research about developing countries like Electronic Journal of Information Systems in Developing Countries (EJISDC). These journals have a high impact factor, for example, at the time of this literature review MISQ had an impact factor of 5.430 (Scimago Lab, 2018) while EJISDC focuses on developing nations and have been used in prior literature review.

The fourth step, *practical screening,* involved searching for two phrases:, firstly, "causes of the second order digital divide in developing countries' higher education"; and secondly a conjunction of the phrases "digital divide" with "higher / tertiary education", and "digital divide" with "developing countries". These phrases needed to be included in the publication's title, abstract and/or keywords. The fifth step, *quality appraisal,* involved carefully reading through each abstract to determine whether a relevant summary of findings, methods and theories was present.

In the sixth step, *data extraction*, the entire publication was read, and the detailed findings, methods, and theories (if any) were recorded. The seventh step, *synthesis*, involved the identification of the most significant findings relating to structures that had been reported as causing the 2nd order digital divide in the relevant context. The final step, *report writing*, encompassed the write-up of an extensive report on the results from the preceding seven steps.

3.3 The Systematic Literature Review Report

It should be acknowledged that while the literature search process was very extensive, it could not be exhaustive of all the relevant literature due to access restrictions, time restrictions and the saturation of findings. The first round of the literature search returned 224 publications as illustrated in Table 3.1, which shows a distribution of the selected publications organised by source and year of publication.

Table 3.1 *Initial Literature Search Results (2010-2019)*

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
EBSCO	1	6	5	3	6	2	0	1	2	2	**27**
ERIC Pro Quest	8	6	6	4	1	5	4	6	7	4	**51**
Google Scholar	12	3	4	6	10	9	7	6	20	29	**107**
ISI Web of Science	3	4	3	3	1	4	2	4	2	2	**28**
Scopus	5	2	0	0	1	1	0	0	1	1	**11**
Total	**29**	**21**	**18**	**16**	**19**	**21**	**13**	**17**	**32**	**38**	**<u>224</u>**

The results in Table 3.1 show that Google Scholar topped the list with 107 publications while Scopus had the lowest count with only 11 publications. The year 2019 had the highest count of 38 publications while 2016 had the lowest count with only 13 publications. This striking finding provides evidence against the emerging misconception that the digital divide is an outdated research phenomenon (Selwyn, 2010). On the contrary these results provide evidence of current research interest in the digital divide phenomenon (van Deursen & Andrade, 2018; Nikolaos et al., 2019). After 20 duplicates had been eliminated, the number of publications was reduced to 204 and after further screening 96 publications remained that satisfied the quality appraisal criteria. It should be noted that in the previous steps the papers were not read in their entirety, just their title, abstract and keywords, the final refinement process involved reading the papers in full. After carefully reading through the entire publication, only 27 of the 96 qualified for inclusion in the final list of publications. Table 3.2 presents a sample of four publications, the complete list of 27 publications was attached to this thesis as Appendix B.

Table 3.2 *Selection of the Literature Review Search Results*

Empirical studies (2010-2019)	Theory/ Model	Methodology / participants / Context	Findings
Gameel and Gwinn (2019), When it comes to MOOCs, where you are from makes a difference. *Computers & Education* 136, 49–60.	Resources and appropriation theory.	Survey (online)/ 2882 learners/ MOOCs universities, Arab States region, Europe, Latin America, the Caribbean, and North American regions.	Investigated the learners' readiness to engage in MOOC-based learning. Results show that the region, self-efficacy and locus of control influence the learner's engagement with MOOCs.
Kaniaru, Karani, and Mirie (2018), Utilization of blended approach mode in teaching and learning for undergraduate nurses in Kenya. *American Journal of Nursing Research*, Vol. 6, No. 6, 466-470.	N/A	Mixed method / 486 lecturers and students / School of nursing in Kenya	Explored the factors influencing engagement in blended learning. Blended learning is affected by lack of confidence in the e-learning system due to system complexity.
Guzmán and Nyvang (2018), From Professors' barriers to organisational conditions in ICT integration in higher education. *Læring & Medier (LOM)*, No18, 1-27.	Cultural-historical activity theory (CHAT)	Qualitative / focus group of professors / National University (UNA), Costa Rica.	Investigated the organisational constraints of ICT adoption and integration in teaching, the results indicate that institutional rules and the community hinder ICT adoption.
Brown and Czerniewicz (2010), Debunking the 'digital native': beyond digital apartheid, towards digital democracy. *Journal of Computer Assisted Learning*, 26, 357–369.	N/A	Mixed / 513 university students / South Africa.	Examined the students' access and use of computers and cell phones in learning. The findings are that familiarity and experience with ICTs influences the digital divide.

The full list of publications is in Appendix B.

3.4 Analysis of Literature Search Results

This section was a follow-up on the findings from the 27 relevant publications that were selected for the purpose of this systematic literature review. The section presented the results of the analysis, which was organised into results from the empirical findings, data collection methods and adopted theories. Figure 3.1 is a concept map of results from the analysis process, organised into three main categories: key factors, methodology and theories.

Figure 3.1 *Concept Map for Literature Review*

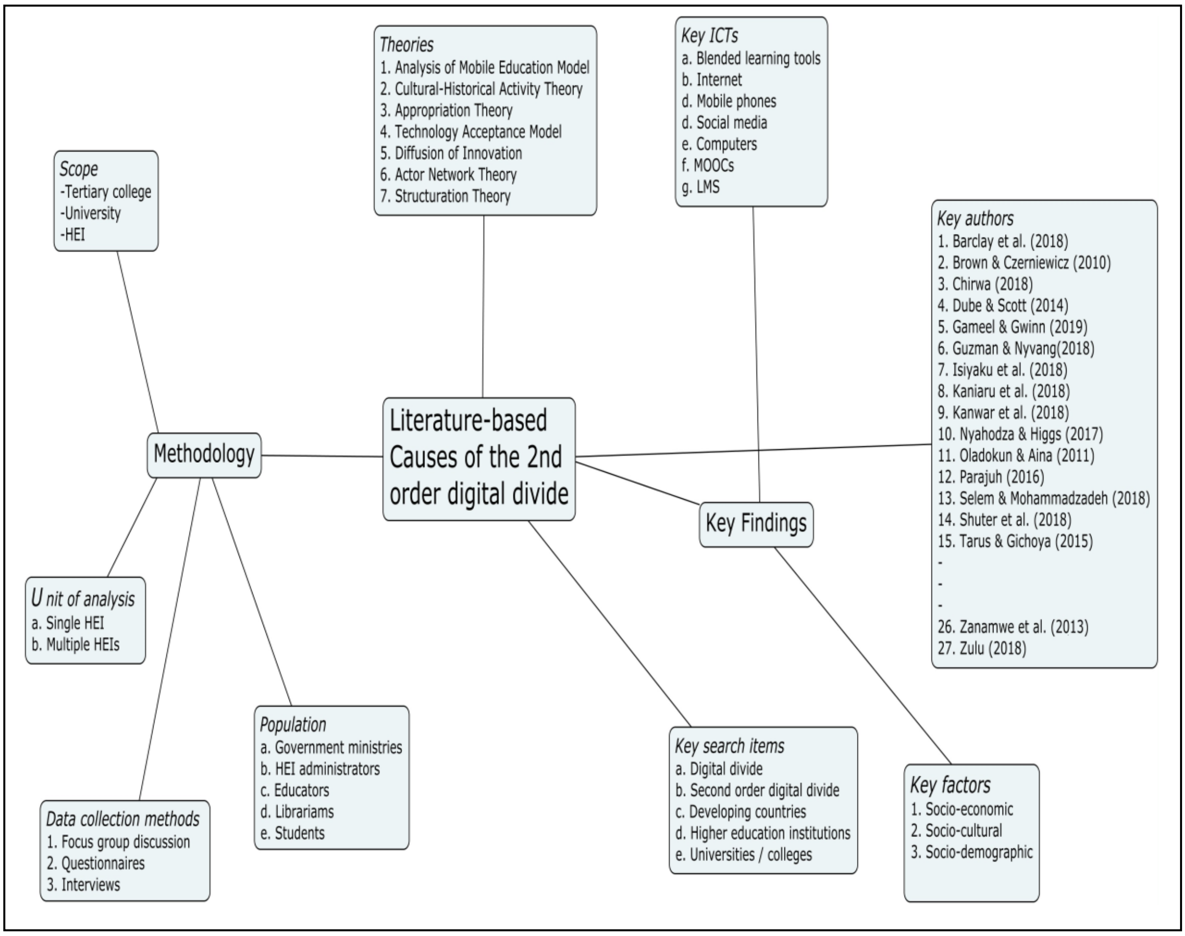
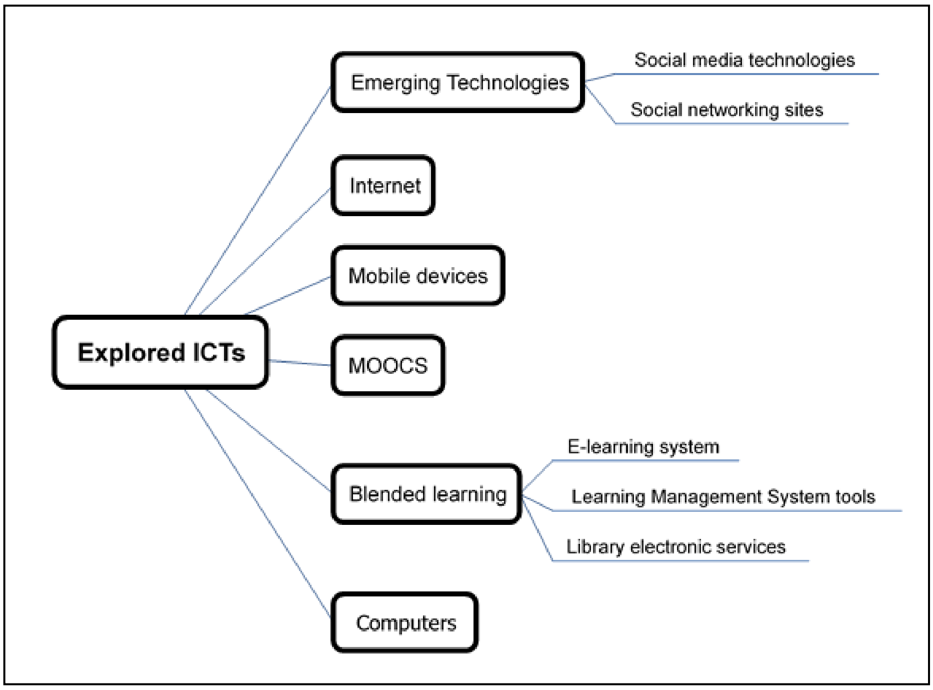


Figure 3.1 depicts a summary of the key results involving the research findings, methodology followed, and the theories adopted. A detailed report is presented in the following section.

3.4.1 Analysis of Findings Reported in Empirical Studies (2010-2019)

This analysis considered two major aspects, the ICTs that were investigated and the existence of structures contributing to the 2nd order digital divide, involving ICT use and skills. Results from the literature review identified a variety of ICT resources depicted in Figure 3.2, which included mobile devices, blended learning tools, MOOCs, emerging technologies, the Internet, and desktop computers. This makes sense, because all these ICTs can be used to transform teaching, learning and research activities.

Figure 3.2 *Most Referenced ICTs*



The second phase of analysis considered the empirical findings, which show that only six of the 27 empirical studies reviewed explicitly referred to the 2nd order digital divide phenomenon in HEIs in developing countries. These six included a survey by Brown and Czerniewicz (2010) whose findings revealed that the 2nd order digital divide evident among students enrolled at a South African university was due to a lack of familiarity and experience with ICTs. Findings from a study conducted in a similar context by Nyahodza and Higgs (2017) indicated that university students in South Africa experience a digital divide as a result of a lack of network availability, of having their accounts hacked, unfamiliar language, lack of ICT skills, ICT inaccessibility and resistance to ICTs.

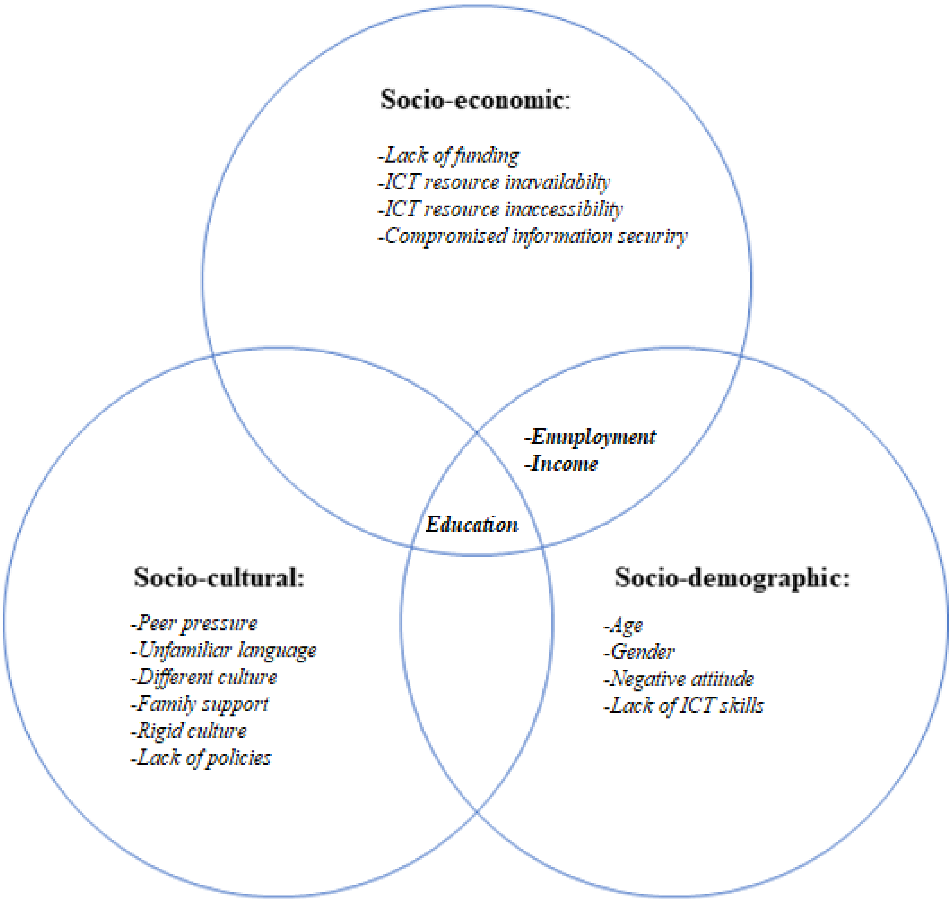
Results from studies by Eyo (2014) and Torres-Diaz and Duart (2015) revealed that low family income rather than gender differences was the main factor contributing to the 2nd order digital divide in HEI cases. These findings are contrary to literature that frequently attributes the 2nd order digital divide to differences in gender where males are usually portrayed as frequent users of ICTs when compared to female counterparts (van Deursen & Andrade, 2018).

The final two studies involved students enrolled at a university in Botswana. The first study, conducted by Oladokun and Aina (2011) identified a lack of computer skills and the geolocation of learners as underlying factors exacerbating the 2nd order digital divide. The findings of a study conducted by Kgosiemang (2016) concluded that the widening digital divide was due to limited access to ICT resources.

Although the findings from the remaining 21 empirical studies are not explicit about the digital divide, they identified factors that provide a basic understanding of the 2nd order digital divide phenomenon in HEIs of certain developing countries. The identified factors include a negative attitude and resistance to technological changes (Salem & Mohammadzadeh, 2018; Shuter et al., 2018; Dube & Scott, 2017a). Shuter et al. (2018) conducted a comparative study involving students of both America and Indian nationalities. Their findings revealed that while the American students embraced the mobile devices as tools for learning, the Indian students displayed a conservative attitude towards the use of mobile devices, which they viewed as a distraction to learning.

Other reviewed studies identified factors including inadequate hardware and expensive software (Barclay et al., 2018; Kaniaru et al., 2018; Mokiwa & Phasha, 2012). A rigid culture, peer pressure, lack of ICT policies, and organisational complications were also identified as implicit causes of the 2nd order digital divide in HEIs within developing countries (Guzmán & Nyvang, 2018; Iqbal & Bhatti, 2017; Isiyaku et al., 2018; Nyahodza & Higgs, 2017). Figure 3.3 depicts the organisation of ICT adoption factors according to the three categories of socio-economic, socio-culture and socio-demography.

Figure 3.3 *Classification of ICT Use Factors in Reviewed Literature*



The classification of ICT use factors that is presented in Figure 3.3 was derived from a study by Srinuan and Bohlin (2011) who documented examples of socio-economic, socio-cultural and socio-demographic factors. Using these examples, the researcher proceeded to classify the factors identified in the literature reviewed for this study to result in the classification in Figure 3.3.

It is worth noting that the publications that were included in the literature review may not reflect an exhaustive account of the factors causing the 2^{nd} order digital divide problem, which is currently significant in HEIs of most developing countries. It is possible that additional causes exist in the literature but were not included in this review due to access restrictions, research scope, participants, context, and timeline, among other issues. Whichever the case may be, the findings from this literature review process have nevertheless contributed towards an initial understanding of the 2^{nd} order digital divide problem in HEIs within developing countries. The next section discusses the data collection methods that were employed in the empirical studies included in the literature review process.

3.4.2 Analysis of Data Collection Methods in the Reviewed Literature

The methods of data collection discussed in this section are categorised into perspectives based on the scope of the study, the research participants, the data collection instruments and the type of data that was collected.

Analysis by study scope

In the previous chapter, I indicated that this study adopted GDP per capita as the criterion for classifying countries as either developed or developing. It is possible that developing countries with a low GDP per capita could be found in any of the world's seven continents. It was therefore sensible to perform a statistical analysis of empirical studies by region as illustrated in Table 3.3. The results of this analysis show that 25 empirical studies were conducted in a single region, and two studies were cross-regional.

Table 3.3 *Empirical Studies by Geographic Region*

Region	Number of studies investigated	Key findings	GDP (US$ million)	World Bank Ranking
Africa	17	Environment and the economy are not favourable for the maintenance of and access to ICT infrastructure, respectively.	2,490	5
Asia	4	Culture, language, and economic conditions are some major causes of the 2nd order digital divide.	34,390	1
North America	3	Human and institutional causes influence the integration of ICTs, for example self-efficacy, HEI rules and the community.	24,880	2
South America	1	Institutional culture and family income influence the level of ICT uptake.	2,900	4
Cross-region	2	Human attitudes towards ICTs, culture and government policies inhibit ICT usage.	-	-

The full list of publications is in Appendix A and the GDP by continent can be found in Appendix C.

The results in Table 3.3 show that the African region had the largest representation of 17 (63%) relevant empirical studies. This could be attributed to the fact that Africa has the largest number of countries, (54), most of which have developing country status. Although the world regions include Europe, Australia and Antarctica, the analysis reveals that there were no specific empirical studies from these regions. This could be attributed to the fact that Europe and Australia are characterised by countries with high GDP per capita, qualifying them as regions of developed countries while Antarctica is less populated due to the weather conditions that is too cold for permanent human habitation. An understanding of the studies by region paved way for the analysis of the study participants.

Analysis of research participants

The study participants were profiled into four clusters relating to university students, lecturers, a combination of students and lecturers, and a combination of students, lecturers and administrators as illustrated in Table 3.4.

Table 3.4 *Participant Profiles*

Cluster	Participants	Number of studies	Key findings
1	Students	14	Popular among students were the demographic, cultural and institutional factors for example, low family income.
2	Lecturers	7	Lecturers mainly cited demographic and institutional factors such as technophobia, peer pressure and lack of management support.
3	Students and lecturers	3	This combined group reported factors involving government and higher education institutions, such as a lack of ICT policies.
4	Students, lecturers, and administrators	3	Cultural, resource non-availability, and environmental factors were identified by this group as a hindrance to ICT use.

The results illustrated in Table 3.4 reveal that students participated in 20 empirical studies, 14 of which were exclusive to students and six of which were in conjunction with other cohorts. Lecturers participated in 13 studies, seven of which were exclusive to lecturers and six of which were in conjunction with other groups. No study involved administrators on their own as a separate group of participants. The next section analyses the types of data that were collected and the instruments that were used to collect the data in the reviewed empirical studies.

Analysis of the type of collected data and data collection instruments.

The collected data was either quantitative, qualitative or a mixture of the two types. A summary of results from the analysis of empirical studies is illustrated in Table 3.5, which is organised into three columns reflecting the research design, type of collected data and number of studies.

Table 3.5 *Empirical Studies by Data Collection Methods*

Research design	**Type of collected data**			**Number of studies**
	Quantitative	*Qualitative*	*Mixed*	
Single case	12	4	3	19
Multiple cases	3	0	4	7
Grounded Theory	0	1	0	1
Total	**15**	**5**	**7**	**27**

It is apparent from Table 3.5 that quantitative data was the most common (56%) followed by mixed data (26%) and lastly qualitative data (18%). Regarding the research design, single-case studies topped the list (70.3%) followed by multiple case studies (26%) and lastly grounded theory (3,7%). All the case studies were cross-sectional, and none were conducted on a longitudinal time frame. Questionnaires were the most commonly used data collection instrument while two studies employed observation and focus groups.

In the above sections I analysed the factors that emerged as contributing to the 2nd order digital divide, the profile of the research participants, and the data collection methods that were used, based on the publications that were included in the literature review process. In the following section I will present the results of an analysis of theories that were employed in the selected sample publications.

3.4.3 Analysis of Theories Used in Empirical Studies (2010-2019)

The results of the theoretical analysis indicated that most of the empirical studies 18 (66.7%) did not employ any specific theory while 9 (33.3%) of the studies employed a theory as indicated in Table 3.6.

Table 3.6 *Theoretical Analysis of Empirical Studies (2010-2019)*

Theory	Article by	Count	Key findings
Actor Network Theory (ANT)	(Govender & Chitanana, 2016)	1	The 2^{nd} order digital divide was attributed to infrastructural and institutional causes.
Critical Theory	(Nyahodza & Higgs, 2017)	1	Human characteristics and HEI infrastructures were implicated as causes of the 2^{nd} order digital divide.
Cultural-Historical Activity Theory	(Guzmán & Nyvang, 2018)	1	The nature of the institution's culture was causing the 2^{nd} order digital divide.
Diffusion of innovation (DOI)	(Kanwar, Carr, Ortlieb, & Mohee, 2018)	1	The 2^{nd} order digital divide was attributed to national, resource unavailability and institutional causes.
Resource Appropriation Theory (RAT)	(Gameel & Gwinn, 2019)	1	The 2^{nd} order digital divide was attributed to regional and demographic causes.
Rational Analysis of Mobile Education Model.	(Iqbal & Bhatti, 2017)	1	The organisation's lack of support for ICT was identified as the main cause for the prevailing 2^{nd} order digital divide.
Structuration Theory (ST)	(Li, 2016)	1	Technological characteristics were causing the 2^{nd} order digital divide.
Technology Acceptance Model (TAM)	(Isiyaku et al., 2018; Barclay et al., 2018)	2	Cultural and infrastructural causes were leading to the 2^{nd} order digital divide problem.
Not specified		18	Sociodemographic causes were identified.

Comparison of these theories is provided in Appendix D.

Two of the nine empirical studies identified in Table 3.6 employed theories that Mason and Hacker (2003) consider to be relevant for digital divide research, these being Diffusion of Innovation and Structuration Theory. Six other theories (Actor Network Theory, Critical

Theory, Cultural-Historical Activity Theory, Technology acceptance Model, Resource Appropriation Theory, and the Rational Analysis Mobile Education model) each guided a single empirical study, while the Technology Acceptance Model was used in two empirical studies.

This section provided a summary of findings from the systematic literature review. It is apparent from these findings that many empirical studies not only made an implicit reference to the digital divide phenomenon, but also attributed this phenomenon to ICT use factors and not structures. At this point it was imperative to demonstrate that on one hand, the factors are surface, simple, and more obvious since they only relate to general circumstances that influence the adoption of ICTs such as non-availability of ICT and energy resources. On the other hand, structures are deeper, complex, and more hidden such that factors are rooted in them, for example, institutional and government structures determine the availability of ICT and energy resources.

The methods of collecting data were biased towards quantitative data, collected mainly through questionnaires. Only a third of the total studies were guided by an existing theory. The next section of this chapter will explain the implications of the results of the systematic literature review with regard to practice, methodology and theory.

3.5 Implications of the Empirical Studies (2010-2019)

The previous sections provided a detailed analysis of the selected empirical studies; this section discusses the implications of the results in terms of practice, methodology and theory.

3.5.1 Practical Implications

The analysis of the findings revealed that only six of the 27 empirical studies reviewed explicitly discussed the digital divide problem in HEIs within developing countries, which was not significantly representative of the sample. Despite the research needs of developing countries much of the 2nd order digital divide research is based on empirical studies based on HEIs in developed countries. For example, Padilla-Carmona, Suárez-Ortega and Sánchez-García (2016) investigated the causes of digital exclusion in Spain's HEIs; while Nikolaos et al. (2019) investigates the presence of the 2nd order digital divide at a Greek university.

The digital divide phenomenon is considered to be a vicious cyclic problem which is simultaneously complex, dynamic and entrenched (van Dijk & Hacker, 2003; Selwyn, 2010; Oh & Kathuria, 2010). It is therefore a paradox that the 2nd order digital divide problem has been ignored for so long in studies conducted in HEIs in developing countries. There remains a gap in the literature that deserves scholarly attention if this problem is to be alleviated (Selwyn & Facer, 2014; Henderson et al., 2015).

It is also apparent from the findings of the literature review that the structures leading to the 2nd order digital divide in HEIs in developing countries remain unknown or have not been sufficiently clearly defined (Muyinda et al., 2019; Njaya & Murangwa, 2017). It should be noted that in this study, structure is conceptualised from the perspective of both Archer (2010) and Giddens (1984) to reflect the underlying conditions that enable or constrain the use of resources such as the ICT infrastructure. These underlying conditions could either be physical such as financial resources or abstract such as procedures that govern the utilisation of ICT resources.

It was on this background that the claim there was a narrow consideration of inherent structures was justified by Scheerder et al. (2017), who claim that the concept of structures leading to the 2nd order digital divide appears to be an under-researched phenomenon. Similarly, van Deursen and Andrade (2018) argue that an explanation of the structures that lead to the 2nd order digital divide is an important concern of academic research. This view confirms an earlier observation by van Dijk (2006) that the deeper structures leading to this digital divide have not yet been addressed. Literature therefore points to an urgent need for empirical studies that will explain the structures that are implicated in the 2nd order digital divide beyond the obvious and superficial factors (van Deursen & van Dijk, 2014; Scheerder et al., 2017).

In line with the sentiments highlighted in the previous paragraphs, Campos-Castillo (2015) has called for research that examines the deeper structures causing the 2nd order digital divide in HEIs. Similarly, a study by Robinson et al. (2015) emphasises the importance of uncovering the mechanisms behind the 2nd order digital divide, while Nikolaos et al. (2019, p.60) conclude that "the bridging of the digital divide has to be a priority for policies in order to implement new digital teaching and learning processes at all levels of education". Such research would be of value to both digital divide researchers and HEI policy-makers (Sagrista & Matbob, 2016; Robinson et al., 2015). So far, this section has provided a well-justified motive for proceeding with this research towards identifying and explaining the structures leading to the 2nd order digital divide in HEIs within developing countries. The next section presents the implication of the literature review findings on the research methodology.

3.5.2 Methodological Implications

Analysis of the data collection methods used in the reviewed empirical studies revealed a bias towards quantitative rather than qualitative data. These results confirm the observation made by van Dijk (2006, p. 232) that "most digital divide research is based on quantitative data". A similar observation is made by Kundi et al. (2010), who claims that traditionally, quantitative studies have dominated the field of digital divide research. Without ignoring the importance of quantitative studies, data collected through quantitative methods is usually limited in explanatory capabilities when compared to qualitative data. Data collected through qualitative methods can answer the *why?* and *how come?* questions and not merely the *how much?* questions that are answered by quantitative designs. With these limitations in mind, and since the collection of data is usually guided by a theory, the next section presents the theoretical implications of the results of the literature review.

3.5.3 Theoretical Implications

The theoretical analysis indicated that most of the empirical studies were not guided by any theory. Only nine empirical studies employed a theory, and only two of those employed theories that are considered appropriate for digital divide research. These results support the observation by van Dijk (2006) that digital divide research is rarely discussed from the perspective of a theory that goes beyond the adoption and diffusion factors. Seven studies employed the ICT adoption, acceptance or appropriation theories, which are considered to be descriptive rather than explanatory (Selwyn, 2012; van Dijk, 2006; Nawaz, Awan, & Ahmad, 2011). This renders them less appropriate for research seeking to provide an explanation of the structures leading to the 2nd order digital divide problem in HEIs within developing countries (see Table 3.6).

In conclusion, the reviewed empirical studies had several limitations relating to the actual findings that emerged, the data collection methods that were used, and the theories that were employed. These limitations point to three major gaps of practice, methodology and theory, which are highlighted in the next section.

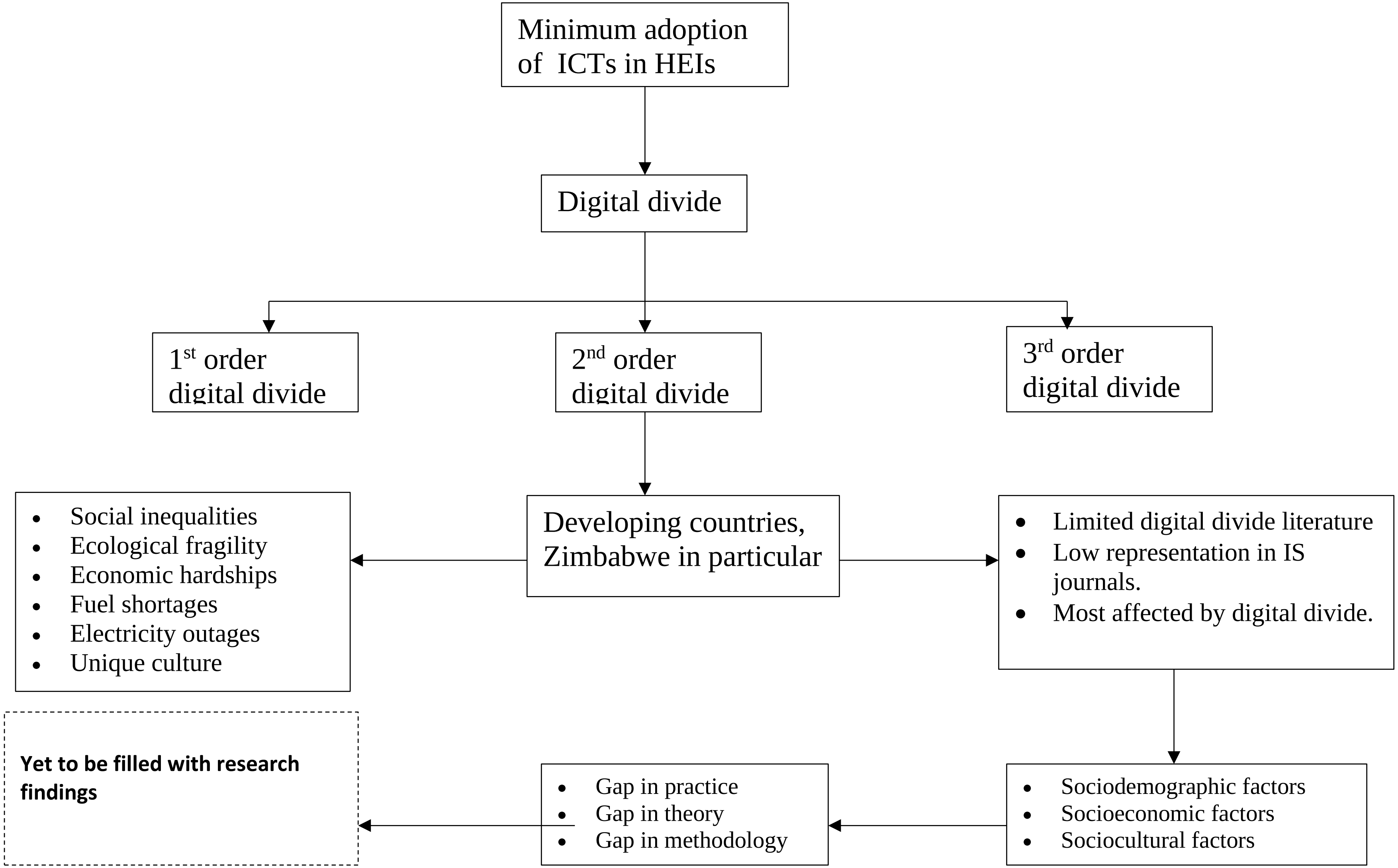
3.6 Gaps in Existing Literature

Three discrete gaps emerged from the selected publications that were included in the literature review. Missing from the reviewed literature was an explicit explanation of the underlying structures that lead to the 2nd order digital divide problem in HEIs within developing countries. While several studies attempted to explain the causes of the 2nd order digital divide, none of these studies either identified or fully explained the structures implicated in this phenomenon. Instead, the 2nd order digital divide was only attributed to sociodemographic, sociocultural, and socioeconomic factors.

Another missing link in the reviewed literature relates to a bias towards quantitative data collection methods, while qualitative methods were less visible. A comparison of the two data collection methods revealed that qualitative data was collected by very few of the sample studies that were reviewed. Many studies collected quantitative data, which was appropriate for descriptions and predictions, but not for explanations. However, literature comparing results from data collected using popular methods concludes that qualitative data is richer and more insightful than quantitative data; (Darke, Shanks, & Broadbent, 1998; Miles, 1979). The last gap in the literature concerns a limited theoretical grounding. Very few of the reviewed studies were guided by an appropriate theory for theorising about the 2nd order digital divide problem as it is experienced in the context of HEIs within developing countries.

The evidence from these results suggests that the literature still contains gaps in practice, in methods of data collection and in theory. A gap in practice is supported by Njenga (2018) and Scheerder et al. (2017) who observe that the 2nd order digital divide is usually explained through sociodemographic, sociocultural and socioeconomic factors. In addition, Nantongo and Hetland (2020) note that there is limited research on the digital divide that in the context of HEIs within developing countries. Regarding methodology and theory, van Dijk (2006) observes that a major shortcoming of digital divide research is the limited variety of data collection methods and the lack of theoretical grounding. It is therefore reasonable to conclude that more work is needed to address these gaps. An overview of the literature review process and findings is presented in Figure 3.4.

Figure 3.4 *Overview of the Literature Review Process*



3.7 Conclusion

This chapter reported on the results obtained from a systematic review of literature regarding the structures that lead to the 2nd order digital divide in HEIs in developing countries. Findings from the 27 articles that satisfied the screening process pointed to a gap in practice, in data collection methods and in theory. Unfolding from the analysis of findings was the realisation that the structures leading to the 2nd order digital divide problem have not been fully explained. Instead, the 2nd order digital divide in this context was attributed to sociodemographic, sociocultural, and socioeconomic factors. This limited understanding could be attributed to shortcomings in data collection methods as well as in theoretical grounding, which the digital divide literature appears to suffer from. The gap of theory is filled in the next chapter, which proposes Structuration Theory as the appropriate alternative for this study.

Chapter 4: Theoretical Basis - Structuration Theory

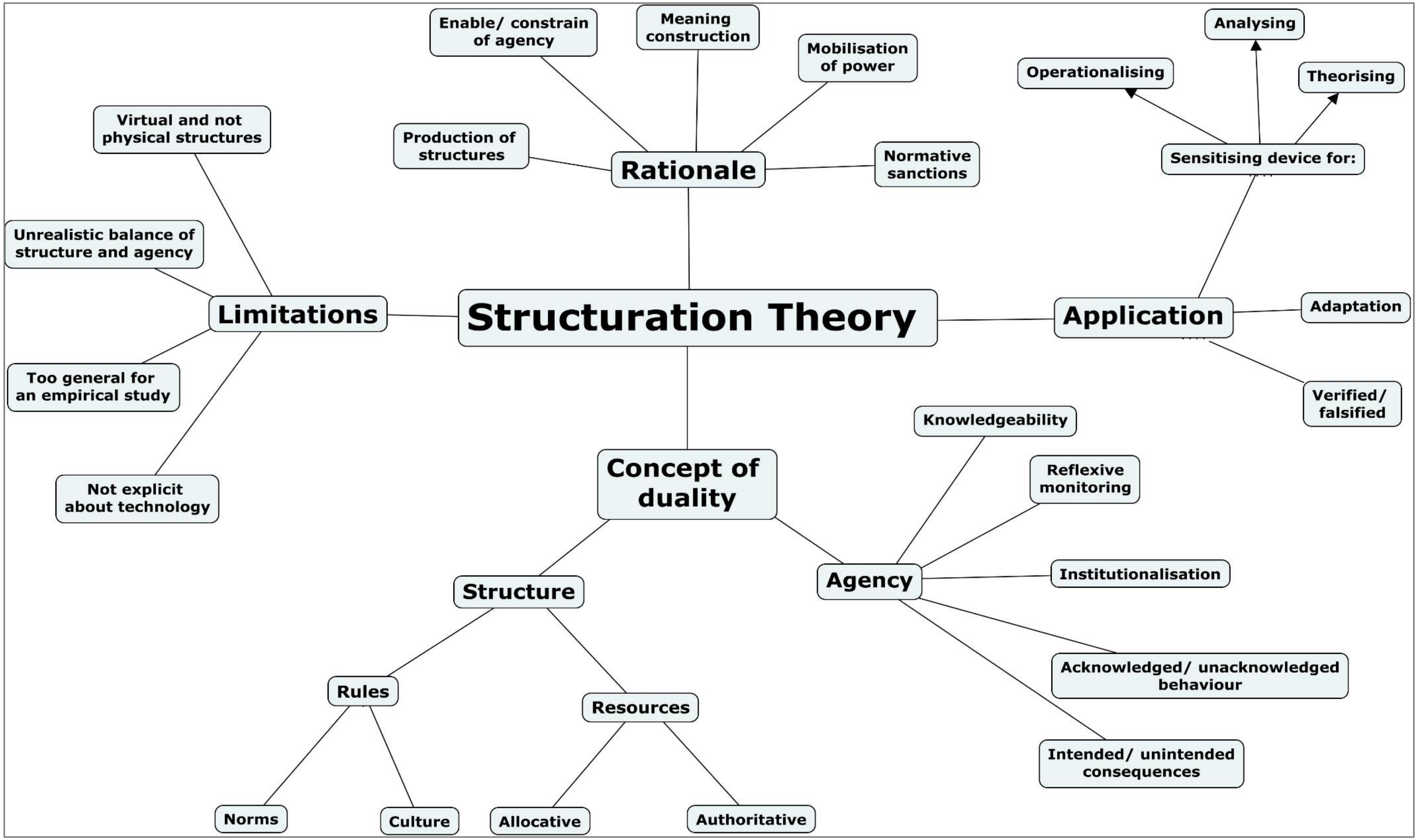
4.1 Introduction

In the previous chapter I identified a gap in the digital divide literature relating to the limited theoretical grounding, which I argued could be affecting the full explanation of the structural causes of the 2nd order digital divide phenomenon in HEIs within developing countries. It was with this backdrop in mind that the current chapter proposed that Giddens' Structuration Theory was an appropriate alternative for addressing the theoretical gap in digital divide literature. Structuration Theory's concept of the duality of structure and agency (Giddens, 1984) would afford an understanding of the structures that are produced and, which in turn constrain the adoption of ICTs to result in the 2nd order digital divide in HEIs within a developing country context.

Despite acknowledging the affordances of Structuration Theory as a starting point for this study, this was not to say that it was the best but rather a better alternative than other counterpart theories. On this note, the chapter's initial section compares Structuration Theory with other possible candidate theories for guiding this research and explains why it was a more suitable theory. The section that follows, presents the literature-based limitations of Structuration Theory.

This was followed by a section that refers to empirical studies in similar research areas that were conducted using the lens of Structuration Theory, to demonstrate how the concepts of this theory have been successfully applied in similar research. The next section details the key concepts of Structuration Theory, with the duality of structure and agency being the core concept relevant to this research. A section that justifies the rationale for adopting Structuration Theory for this research then follows. The chapter conclusion refers to the next chapter, which capitalises on the methodological richness of Structuration Theory to generate novel data. Figure 4.1 maps the core concepts of Structuration Theory that are discussed in this chapter.

Figure 4.1 *Concept Map on Structuration Theory*



4.2 The Limitations of Popular Digital Divide Theories

Since the digital divide phenomenon is not new in research, several theories exist that have attempted to understand and explain it. This section compares and contrasts four possible theories for guiding this research in terms of their purpose, focus/ target, application, strength / weakness, scope or relevance to this research on digital divide. These comparison metrics were derived from literature. For example, Pick and Sarkar (2016) used similar metrics in a digital divide study that compares Unified Theory of Acceptance and Use of Technology (UTAUT), Spatially Aware Technology Utilization Model (SATUM), Use Diffusion Theory (UDT) and van Dijk Theory. The clarity of the findings motivated this research to adopt the same metrics to justify the validity of the chosen theory for this study.

The four theories included but are not exhaustive of Technology Acceptance Model (TAM), Diffusion of Innovation (DOI), Technology Organisation and Environment (TOE) and Structuration Theory (ST). Despite their importance, some theories in Table 4.1 were not capable of fully explaining the structures that lead to the 2nd order digital divide phenomenon.

Table 4.1 *Common Characteristics of Digital Divide Theories*

Comparison metrics	TAM	DOI	TOE	ST
Purpose	Acceptance	Assimilation	Adoption	Interaction
Role of individuals	Emphasised	Emphasised	Not explicit	Emphasised
Role of social processes	Not explicit	Considered	Emphasised	Emphasised
Nature of application	Descriptive studies	Descriptive studies	Descriptive studies	Explanatory studies
Explanatory power	Limited	Limited	Medium	Absolute
Level of analysis	Micro	Micro and Macro	Macro	Micro and Macro
Relevance to digital divide studies	Low	Medium	Low	High

Table 4.1 depicts common characteristics regarding the purpose, role of individuals, role of social processes, nature of application, explanatory power, level of analysis and relevance of each of these theories. The content of Table 4.1 shows the strengths and weaknesses of TAM, DOI, TOE and ST as potential candidates for theorising about the 2nd order digital divide phenomenon in the HEI of a developing country. A detailed discussion about each of these theories is provided in the next section.

4.2.1 Technology Acceptance Model (TAM)

Davis (1985) developed TAM as a theoretical basis for describing how perceived ease of use and perceived usefulness influence users' *acceptance* of technology. Archer (1995) argued that such a bias towards a micro level unit of analysis leads to what she terms an *upward conflation*, which is a concept describing a scenario where supremacy is accorded based on individuals' voluntary actions at the expense of the society they operate in. Similarly, Giddens (1984) acknowledged the idea that an emphasis on voluntary actions, detaches those actions from the context in which they occur. More recently, Baker (2011) has observed that perceptions about the characteristics of a technology are core to TAM, implying that TAM targets *individual users* as the unit of analysis that occurs at the *micro level*. The broader *social system* has no explicit significance for TAM, which means that no analysis occurs at a *macro level*. This discourse showed that TAM was an appropriate theory for research that seeks to describe or predict the acceptance of a technology (Easton, 2010). However, TAM was *not relevant* for the current research, which seeks to explain the hidden structures contributing to the 2nd order digital divide phenomenon of interest. Based on the preceding discussion, I conclude that TAM could be a necessary but was not a sufficient theory for identifying and explaining the structures leading to the 2nd order digital divide in the HEI of a developing country. The next theory to be considered was the Diffusion of Innovation theory (DOI).

4.2.2 Diffusion of Innovation (DOI)

DOI was developed by Rogers (1995) to explain the diffusion process of an innovation. Like TAM, the central focus of DOI is *individual perceptions* about the attributes of an innovation, involving its relative advantage, complexity, compatibility, trialability and observability (Sahin, 2006). Unlike TAM, DOI relates actions of users to the *social system* in which they operate, which means that the phenomenon is described from both the *micro and the macro levels of analysis*. Despite this important quality, DOI was limited for this study in two ways. Firstly, DOI simply describes the *assimilation of an innovation and does not explain how the phenomenon emerges* (Mason & Hacker, 2003). Secondly, DOI focusses on the stage and rate of the diffusion of an innovation while ignoring the *interlocking dynamics leading to non-adoption of the innovation* (Sahin, 2006). This implied that DOI could be a necessary but was *not a relevant* and sufficient theory for explaining the underlying structures leading to the 2nd order digital divide. These limitations necessitated the consideration of yet another theory, TOE for this study.

4.2.3 Technology, Organisation, and Environment (TOE)

TOE is an organisation-level theory that outlines the technological, organisational and environmental elements of a firm's context, which influence the decision to adopt an ICT innovation (Baker, 2011). While TOE provides an effective framework for understanding the determinants of ICT adoption and assimilation, it is not explicit about the actions of the *individual users* of the adopted ICTs. Archer (1995) concludes that such an approach suffers from a problem of *downward conflation* where human actions are submerged within the surrounding social structures. Baker (2011) acknowledges that TOE lacks *explanatory strength* which is required in the current research. This implied that TOE was *not relevant* since it could result in a narrow explanation of the dynamics implicated in structures contributing to the 2nd order digital divide.

Despite the recognition that TAM, DOI and TOE are necessary theories, the preceding discussions revealed that these theories are not sufficient for explaining the structures leading to the 2nd order digital divide. They are biased towards either micro or macro levels of analysis by emphasising either the voluntary actions of individuals or the determinant aspects of the social system (Orlikowski, 1992; van Dijk, 2006; Selwyn, 2012; Rambe & Chikobvu, 2014). The descriptive nature of such theories leads to an oversimplification of complex phenomena (Gunkel, 2003; Selwyn, 2012). It can thus be concluded that these theories lack a balanced view and an explanatory capability which is equivalent to that provided by Structuration Theory. These capabilities suggest that Structuration Theory was be a more suitable alternative theory for this research, which sought to explain rather than describe a phenomenon.

4.2.4 Structuration Theory (ST)

Structuration Theory was developed Giddens in order to emphasise the duality of structure (rules and resources) and agency (the capacity to act) (Giddens, 1984). It has its foundational assumptions on social issues making it more of a social than an information systems theory, which explains why Structuration Theory does not directly refer to ICTs (Jones & Karsten, 2008). Structuration Theory was developed with a focus on the constitution of the human society (Giddens, 1984). Structuration Theory shows that both the individual's freedom (agency) and social structures have equal importance on influencing the concerned individual. Although, Structuration Theory has been criticised for several shortcomings discussed in the following paragraphs of this section, it has been widely used in research as is evident in the discussion in section 4.4. According to Structuration Theory, social structure and agency co-exist over time and space (Lyytinen & Ngwenyama, 1992; Dutta, Malhotra, & Zhu, 2016; Pozzebon & Pinsonneault, 2001). Figure 4.2 illustrates a model of Structuration Theory's concept of duality of structure and agency.

Figure 4.2 *The Structuration Model (adapted from Giddens, 1984)*

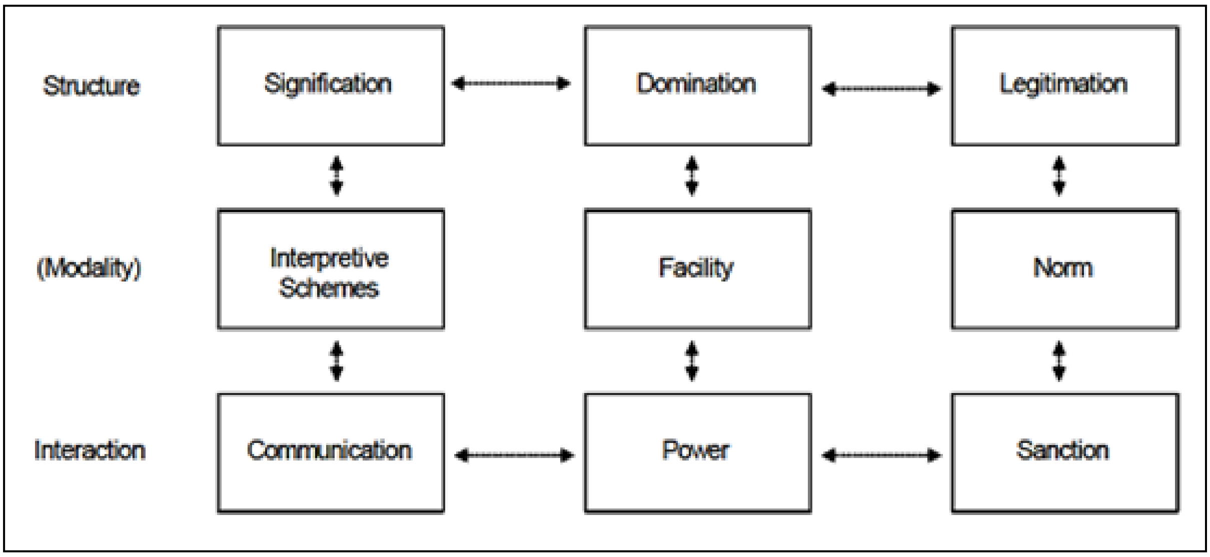


Figure 4.2 is a structuration model consisting of three structural dimensions: signification, domination, and legitimation, which are the terms used by Giddens (1984) to describe structure. These structures are linked to three corresponding dimensions of agency (interaction): communication, power, and sanction. The interaction between structure and agency is through the corresponding modalities of interpretive schemes, facilities, and norms. Structures of *signification* relate to meanings drawn from interpretive schemes via communication; structures of *domination* relate to power relations based on the facility to allocate resources; and structures of *legitimation* relate to moral orders that are sanctioned by social norms (Lyytinen & Ngwenyama, 1992).

Structuration Theory provides a *balanced view* of the effects of people's voluntary actions and the determinants of the social structures within which they occur (Orlikowski & Robey, 1991). Structuration Theory also provides a platform for analysing a phenomenon from both the *micro and macro levels* (Giddens, 1984). This made Structuration Theory a *relevant* alternative since it facilitates an *explanation of a phenomenon in its entirety* (Omotayo & Tiamiyu, 2017; Bornman, 2016). This is consistent with literature, which shows that a phenomenon is more understandable if explained holistically (Lyytinen & Ngwenyama, 1992). Structuration Theory is associated with methodological richness (Pozzebon, 2000), which affords it the *explanatory* power anticipated in research like this. Orlikowski and Robey (1991) conclude that Structuration Theory balances the subjective views of human actors with the established objective laws of the universe within which they operate; balances macro with micro levels of analysis; and balances the qualitative and quantitative methods of data collection. It was with these qualities in mind that I adopted Structuration Theory as a suitable alternative for explaining the digital divide problem beyond simple factors. Nevertheless, Structuration Theory was not without limitations, which are discussed in the next section.

4.3 Limitations of Structuration Theory in Digital Divide Research

Literature has recognised several challenges relating to the use of Structuration Theory in Information Systems research, such as the *non-explicit reference to technology* (Jones & Karsten, 2008). The shortcomings of Structuration Theory led to its adaptation and extension by scholars like Orlikowski (1992) and Desanctis and Poole (1994) to include the missing construct of technology. It was therefore possible that by applying Structuration Theory, this study might face similar challenges, which may prompt the adaptation or modification of Structuration Theory to suit the problem at hand.

Archer (2010) also criticises Structuration Theory's balanced view of the duality of structure and agency, which she argues makes Structuration Theory conflating in nature. This means that Structuration Theory is criticised for an *over-emphasised balance between structure and agency*, such that they not only co-exist but in fact depend on each other. In nature, it is not always possible to achieve such a mechanistic balance. Archer (2010), therefore contends that Structuration Theory overlooks the fact that there are instances in life where structures exhibit more influence than agency and vice versa. This implies that some phenomena could be better explained by either social structures or by agency rather than by the duality of both. In the current research study, it would be expected that structures for explaining the 2nd order digital divide might relate more to the voluntary actions of core stakeholders within the HEI rather than being determined by structures that are exhibited by the HEI as a social system.

Another controversy of Structuration Theory is the emphasis on *virtual instead of physical structures* (Jones & Karsten, 2008). Again Archer (2010) strongly criticises this concept of virtual structures arguing that physical structures also exist which can constrain the human capacity to act, and such constraints cannot be ignored. For example, it would not be reasonable to imagine that one can pass directly through a wall by simply believing that the wall is virtual and does not have a physical existence. In the same manner, the structures leading to the 2nd order digital divide could be physically real and not only reside virtually as traces in the memories of actors.

Information Systems researchers have also been concerned about the *level of generality found in Structuration Theory*, which makes it difficult to use in empirical studies (Pozzebon, 2000; Archer, 2010). A study by Jones and Karsten (2008, p. 129) shows that Giddens' Structuration Theory best "deals with social phenomena at a high level of abstraction rather than their particular instantiation in a specific context". Similarly, Rose and Scheepers (2001, p. 219) conclude that "Structuration Theory is too complex, diverse and alien to be adapted wholesale" to a specific empirical research context. This meant that Structuration Theory could present potential problems when used to discuss the structures leading to the 2nd order digital divide in the empirical situation of the HEI within the specific context of a developing country. Despite these limitations, Structuration Theory remained a suitable alternative theory for guiding this research as was evident from its successful application in similar research projects, as discussed in the subsequent section.

4.4 Application of Structuration Theory in Digital Divide Research

Structuration Theory offered several important characteristics that are relevant to this research. For example, the concept of the duality of structure and agency provides an analytic framework for identifying structures that are produced and then in turn constrain the adoption of ICTs in the HEI. Structuration Theory also maintained a balanced view of the macro and micro levels of analysis (Giddens, 1984; Orlikowski, 1992). This balanced approach of Structuration Theory was important for capturing meanings shared by individual stakeholders and determinant structures at an institutional level. By doing so, Structuration Theory facilitated an explanation of a phenomenon in its entirety (Pozzebon & Pinsonneault, 2005; Rose, 1998; Rose & Scheepers, 2001). Structuration Theory also offers a methodological richness (Pozzebon, 2000). This meant that if the collection of data were guided by the concepts of Structuration Theory, this could result in an insightful explanation of the structures leading to the 2nd order digital divide in the HEI.

Structuration Theory was also a useful sensitising tool for theorising, analysing and operationalising in Information Systems research (Rose, 1998). For example, Lyytinen and Ngwenyama (1992) used Structuration Theory to demonstrate how the production of the structures of signification, domination and legitimation influence Computer Supported Cooperative Work (CSCW) in organisations. Structuration Theory could be applied in a similar way to demonstrate how HEI stakeholders produce the signification, domination and legitimation structures that constrain the adoption of ICTs, resulting in the 2nd order digital divide that is widespread in HEIs.

Hardaker and Singh (2011) applied Giddens' Structuration Theory to demonstrate the process of adopting an e-learning system in HEI. Similarly, the concepts found in Structuration Theory can afford the identification of the interlocking dynamics of ICT adoption in the HEI case. Like Orlikowski (1992) and Desanctis and Poole (1994) who adopted Structuration Theory to develop the Duality of Technology and Adaptive Structuration Theory respectively, there was a possibility that the output of this research could be an extension of Structuration Theory, resulting in a model that suits the explanation of digital divide in a developing country.

The concepts of Structuration Theory have also been combined with concepts from other theories to create hybrid methods of conducting research. For instance Nyandiere, Kamuzora, and Lukandu (2012) analysed the adoption of an Enterprise Resource Planning (ERP) system through the lens of Structuration Theory and Activity Theory. Pozzebon (2000, p.1015) combined the concepts of Structuration Theory with those of the "theory of reasoned action, the theory of planned behaviour, technology acceptance model, the cognitive social theory and the social behaviour theory". Follman (2015) analysed how situated learning is enacted and sustained at schools using the lenses of Giddens' Structuration Theory, Latour's Actor-Network Theory and Henri Lefebvre's theories on the production of space. In this approach, the capability of Structuration Theory was both reinforced and complemented by the concepts of the accompanying theories. It was, however, unfortunate that no specific constructs from these other theories could facilitate the identification and explanation of the deeper structures that contribute to the 2nd order digital divide in the HEI of a developing country in the same manner that Structuration Theory promised to.

This section has demonstrated how Structuration Theory has been successfully applied in similar research. These examples also allowed me to demonstrate that Structuration Theory was suitable for this study. The effective application of Structuration Theory, however, depends on an understanding of the key concepts that are presented in the next section.

4.5 Structuration Theory's Key Concepts

Structuration Theory's *duality of structure and agency* was the key concept of interest for this empirical study. The duality lies in the fact that on one hand *structures*, which refer to rules and resources are produced during human activities. On the other hand, *agency*, which is the capacity to act to produce structures, is either enabled or constrained by the produced structures. The following sections extend the discussion on these key concepts of Structuration Theory.

4.5.1 Agency

Giddens (1984) defines agency as the capacity to act, by individual actors or a group of actors (agent). He identifies the five key characteristics of agency as- knowledgeability, reflexivity, institutionalisation, intended or unintended consequences and acknowledged or unacknowledged behaviour.

Knowledgeability refers to the act of being informed about one's actions and their consequences. Giddens (1984) relates knowledgeability to being learned and possessing useful information for decision making regarding daily social practices. Humans can draw from their knowledge to explain their conduct, and to articulate and express their values or interests (Ranson et al., 1980). There are two broad forms of knowledgeability, which involve consciousness and unconsciousness (Giddens,1984).

Consciousness relates to practical and discursive knowledge. *Practical consciousness* is knowledge observable in action while *discursive consciousness* is knowledge that is verbally articulated (Orlikowski, 1992). *Unconsciousness*, refers to incomplete or distorted pieces of information that lead to actions that occur spontaneously without the actors' awareness of them (Giddens, 1984). The foundational assumptions of this study are that lecturers and students depend on knowledge from practical and discursive consciousness as well as unconsciousness for their decisions to engage in an action to adopt ICTs. It was therefore important to elicit such knowledge in order to understand the interlocking dynamics of ICT adoption and to deduce the underlying structures that support the 2nd order digital divide in the HEI of a developing country. A further characteristic of Structuration Theory was reflexivity.

Reflexivity relates to human actors' attentiveness to their environment in order to monitor actions and routine social practices that can be emulated. Ranson et al. (1980) contend that reflexivity is valuable for improving people's experiences. By adopting the concept of reflexivity this study gained insight into the lived experiences of students and lecturers, which influence the adoption of ICTs. Once established, these past experiences may reveal the interlocking dynamics of ICT adoption and underlying structures that together explain the 2nd order digital divide problem. Linked to reflexivity was the institutionalisation of specific routines that in time become standard practices within a social system like the HEI.

Institutionalisation involves the standardisation of routines and social practices to create the culture, norms, beliefs, and values that ascribe meaning to human actions**.** For instance, Ranson et al. (1980) refer to an organisational case where routines and habitual operating practices became institutionalised into an acceptable culture that defined that particular organisation. This study benefited from an understanding of routine practices that might have contributed to the existing educational culture with or without ICTs. Such institutionalised routines were also an important aspect in the identification of acknowledged or unacknowledged behaviours.

Acknowledged or unacknowledged behaviours relate to behaviours that are either acceptable or unacceptable. Giddens (1984) refers to situations where actors can participate in either acknowledged or unacknowledged behaviours, which can in turn be either supportive of or detrimental to organisational goals. By identifying such acknowledged or unacknowledged behaviours, the interlocking dynamics of ICT adoption could unfold and the resultant structures leading to the 2nd order digital divide will be uncovered. Acknowledged or unacknowledged behaviours are associated with Structuration Theory's concept of intended or unintended consequences, in that the behaviours could lead to actions that were not envisaged.

Intended or unintended consequences: Intended consequences are the anticipated outcomes from an action, while unintended consequences are outcomes that might not have been imagined prior to the engagement in a particular activity. Giddens (1984) recognises that there are situations when unintended consequences emerge from acknowledged behaviours. This implied that while acknowledged behaviours are usually associated with intended consequences, it was also possible that acknowledged behaviours could result in unintended consequences. Although this is not always the case, “unintended consequences can be disruptive in the reproduction of social systems” (Karsten, 1995, p. 9). For example, Sanders and George (2017) refer to a case of school learners who participated in unacknowledged behaviours involving the abuse of Tablet PCs, which resulted in unintended non-educational outcomes. This study could benefit from an understanding of both the intended and the unintended consequences of ICT adoption, to afford an explanation of the hidden structures emerging from these consequences that may lead to the 2nd order digital divide problem. These crucial aspects of agency were fundamental to the production of social structures as presented in the next section.

4.5.2 Structure

Structure refers to the flow of ongoing actions that are bound by rules and resources. Structuration Theory conceptualises structures as virtual, residing as memory traces that must be instantiated in action over time intervals (Giddens, 1984; Lyytinen & Ngwenyama, 1992). This means that structures vary with the context and time of action. Giddens (1984) refers to two elements of structure, which are rules and resources.

Rules are guidelines for regulating social activities, such as codes of conduct, ethical codes and policies (Lyytinen & Ngwenyama, 1992). Rules promote good practices while discouraging unacceptable practices. As a result, students, and lecturers at HEIs are likely to rely on institutional rules to regulate their education practices. An understanding of the rules defined in institutional documents was vital for identifying structures that enable or constrain the adoption of ICTs. In this sense, rules relate to both the structures of signification, by constituting meaning about an action, and the structures of legitimation, through the sanctioning of modes of social conduct (Karsten, 1995). The formulation and application of rules depends on the availability of resources.

Resources include material and human resources, also known as allocative and authoritative resources respectively (Karsten, 1995). Power relations are central for commanding control over both allocative and authoritative resources (Giddens, 1984). For example, human actors exercise power when distributing resources and their intentions are realised through the availability of resources (Orlikowski & Robey, 1991). By drawing on these resources, human agents tend to produce or reproduce structures of domination, which either enable or constrain agency.

It is apparent from the preceding discussion that structures are both a means to and an outcome of the ICT adoption activity. Structures are a means for enabling or constraining agency and are also a product of agency. In the case of HEIs, it was possible for stakeholders to engage in activities that could result in the production of structures, which later enable or constrain their capacity to adopt ICTs. This view is consistent with Barley (1986) who observes that social structuring is driven by actors' interpretations of *meaning, resources* and *moral order*. Giddens (1984) refers to [them as] signification, domination, and legitimation structures.

a. Structures of Signification

Structures of signification are constitutions of meaning drawn from the interpretive scheme modality, which are communicated through language or action (Lyytinen & Ngwenyama, 1992). Structures of signification are created by human agents who stipulate what is important within a social setting, these determinations may either enable or constrain human activities. In the case of the HEI, the adoption of ICTs is enabled or constrained by the meanings assigned to ICTs and their purpose in education. Structures of signification are linked to structures of domination in the way that significant resources are prioritised and allocated.

b. Structures of Domination

Structures of domination relate to power relations drawn from the modality of facility. This meant that the facility to allocate resources was congruent with the degree of power vested in those in charge (Rose, 1998). For instance, power was mobilised to express how resources were allocated, accessed and deployed (Dutta et al., 2016). In the HEI, it made sense to assume that the adoption of ICTs depended on the use of power to allocate and control ICT resources and the backbone infrastructure. This activity could produce structures of domination, which either enable or constrain the adoption of ICTs. Structures of domination were in turn linked to the structures of legitimation, in that the process of allocating resources and controlling human behaviour reflected the legitimised practices of the social system's moral order.

c. Structures of Legitimation

Structures of legitimation relate to the approval of moral order drawn from cultural norms. Social practices that are aligned to cultural norms tend to flourish while controversial social practices are opposed (Hardaker & Singh, 2011; Rose, 1998). Human agents draw from regulatory norms like policies, standard operating procedures, beliefs, values, cultural systems and moral codes to produce structures of legitimation (Giddens, 1984). This study presumed that there could be structures within the HEI that constrains the adoption of ICTs to result in the 2^{nd} order digital divide.

The social structures constitute the dimensions of signification, domination, and legitimation, which regard the constitution of meaning, resources, and moral order, respectively. Figure 4.3 shows the major elements of a modified model of Structuration Theory that was adapted from Lyytinen and Ngwenyama (1992).

Figure 4.3 *A Model of Structuration Theory, Modified by Macintosh and Scapens, 1990 (Source: Lyytinen & Ngwenyama, 1992)*

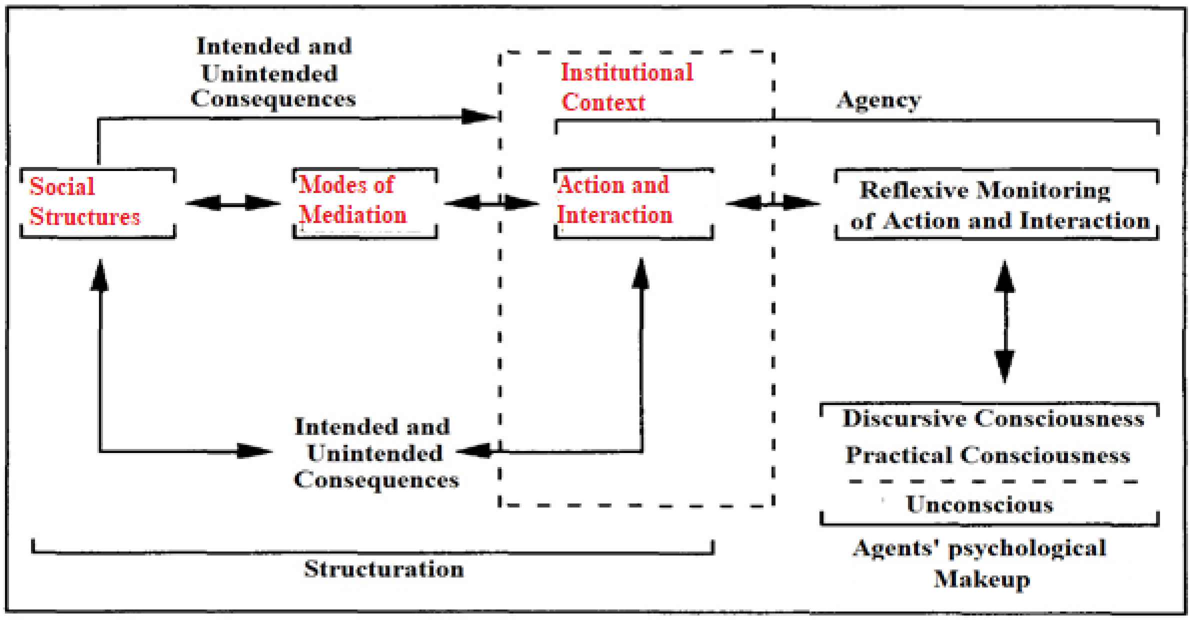
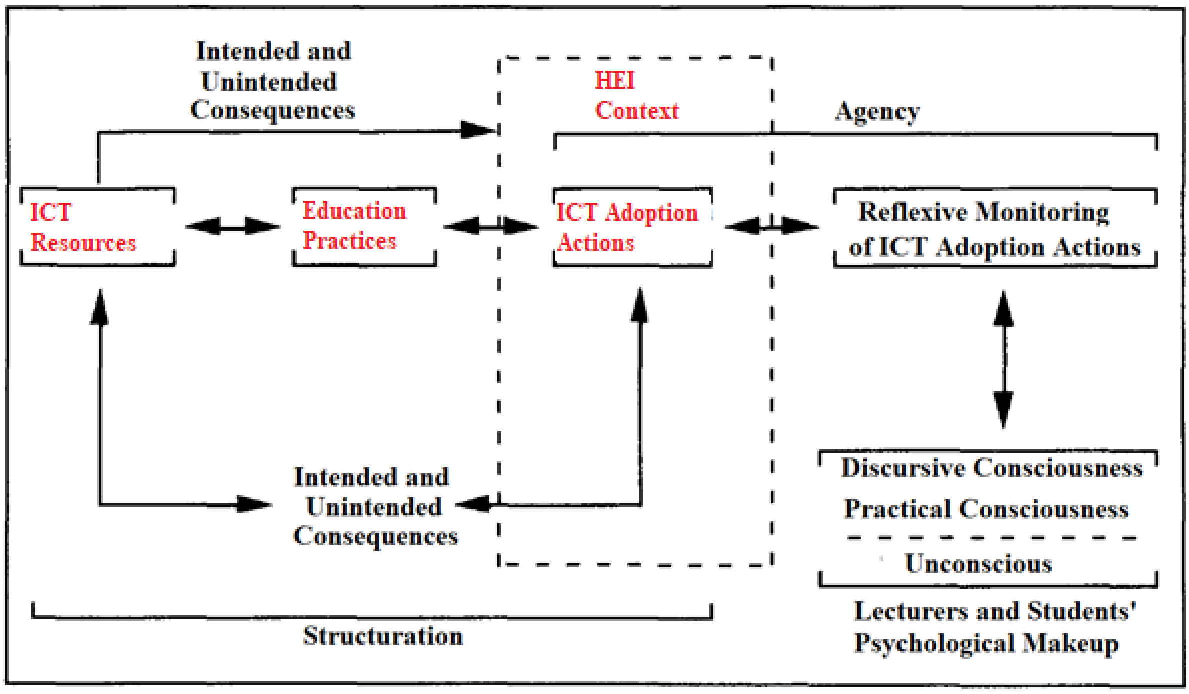


Figure 4.3 shows on one hand, that social structures have intended and unintended consequences affecting agency. Agency, on the other hand, depends on the reflexive monitoring of actions; and actions, in turn, are defined by the discursive and practical consciousness of agents and the unconscious psychological make up of actors, which may result in acknowledged or unacknowledged behaviours (Giddens, 1984). The rationale for adopting the concepts of Structuration Theory is provided in the next section.

4.6 Rationale for Adopting Giddens' Structuration Theory

The previous section presented the key concepts of Structuration Theory; this section demonstrates how those key concepts relate to this study. Figure 4.4 maps this study to the concepts of structure, agency, structuration, institutional context, reflexivity, consciousness, and unconsciousness as first presented in Figure 4.3. The major concepts that guided this study are colour-coded in red to represent the mapping between the adapted theory and the particularisation of those concepts to suit the problem of 2^{nd} order digital divide within its contextual setting of a HEI case.

Figure 4.4 *The Structuration Theory-Based Dynamics of ICT adoption in HEIs*



In the context of the HEI, the concept of *structuration* begins with ICT resources as social structures, which are both the medium and outcome of the actions of the core stakeholders of the HEI. Stakeholders who are in leadership positions within the HEI will acquire, allocate and control the adoption and usage of ICT resources in the practice of education. Such activities may have intended and unintended consequences affecting the capacity to adopt ICTs. This meant that ICT resources and their adoption could have intended outcomes if used in accordance with the leadership plan, and unintended consequences if used in ways that were not imagined when the ICTs were implemented.

In this case, *ICT resources as social structures* included computers, mobile devices, printers, projectors, e-learning systems, websites, portals, e-books, e-journals, and other ICT resources useful for teaching, learning and research. These ICT resources brought with them rules such as manuals, policies, guidelines, etc., which could impact on the action of adopting them as educational tools. Lyytinen and Ngwenyama (1992, p. 24) argue that agency is “affected by the type and nature of resources deployed and rules invoked (structure)”. This meant that the

ICT resources and the rules they bring with them may have both intended and unintended consequences affecting lecturers' and students' capacities for adopting ICTs (agency).

ICT adoption as agency in this case involved the capacity to use ICTs for teaching, learning and research. However, Orlikowski (1992) observe that the execution of a task is influenced by the nature of the underlying social structures. This meant that whether the ICTs are adopted or not depended on the structures of signification, domination and legitimation that are created by this ICT adoption agency. If the structures were enabling, then the ICT adoption was likely to be successful, but if the structures were constraining then the ICT adoption was unlikely to be successful, resulting in the 2nd order digital divide. The context was also implicated in the structuration of structure and agency (Giddens, 1984).

The *HEI as an institutional context* is a social system comprising the culture, traditions and routines that emerge internally to the institution and externally from the society within which it is located (Scott, 1987; Andersson & Grönlund, 2009). Such social systems have *institutional properties,* which enable or constrain human activities (Orlikowski & Robey, 1991; Barley, 1986). These institutional properties can be identified in action following their instantiation (Giddens, 1984). Orlikowski (1992) observes that actions involving ICTs depend on the inherent *institutional properties* that influence agency within a specific setting. Lyytinen and Ngwenyama (1992, p. 31) also acknowledge that "the outcomes of using the technology are largely dependent on the structural properties of the social system". In this case, HEIs are social systems with institutional properties that enable or constrain the capacity to adopt ICTs. An understanding of the HEI context and its properties was important for locating the deeply seated practices that precede the adoption of ICTs in the HEI. For example, the educational culture, ongoing traditions, and routines tend to determine the decision to either adopt ICTs or not. The capacity to adopt ICTs was also influenced by the individual actors or agents who are involved.

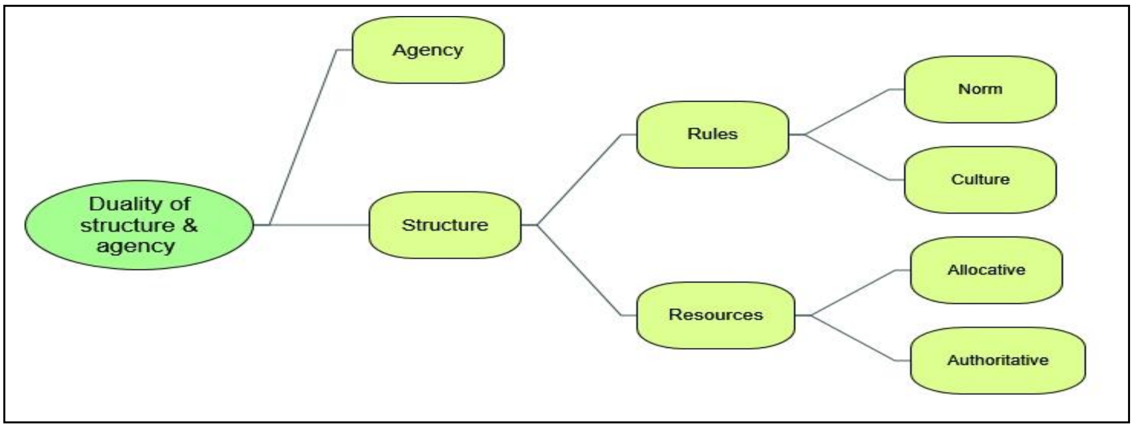
Lecturers and students as agents operating within the HEI have an important role in the production of structures that lead to the 2nd order digital divide. This view follows Orlikowski and Robey's (1991) observation that Structuration Theory enables a problem to be *analysed from the perspective of different units of analysis including* individuals, groups, organisations etc. This meant that the empirical data collected from multiple sources (in this case, the verbal discourses and observations of the key research informants) was vital for constructing an insightful explanation of structures influencing the 2nd order digital divide. Ranson et al. (1980) emphasise the importance of conceptualising how actors act within a social system. In this case, the education-related actions of lecturers and students could not be ignored since those actions could affect the capacity to adopt ICTs as educational tools. The actions of lecturers and students could also provide rich data that results in a deeper understanding of the interlocking dynamics of ICT adoption. Such insights could emerge from the reflexive monitoring of their own and others' actions.

Reflexive monitoring of action involves being attentive to one's surroundings and to how people act within that environment. Reflexive monitoring of one's own and others' actions can enable or constrain social practices (Karsten, 1995). It was possible that by reflexively monitoring their own and others' actions, lecturers' and students' action in adopting ICTs could be impacted either positively or negatively. Data about reflexivity could result in a deeper insight into the interlocking dynamics of ICT adoption and the structures implicated in the 2nd order digital divide. Reflexive monitoring of actions is associated with Structuration Theory's concept of knowledgeability, because as actors monitor their surroundings, they become conscious of the prevailing activities and gain knowledge that they can use to justify their actions.

Agents' knowledgeability is an important concept of Structuration Theory because Giddens (1984) relates knowledgeability to being learned and possessing useful information for decision making. This knowledge was elicited during verbal interviews and focus group discussions and demonstrated in the practice of daily activities. Daily activities may involve unconscious practices that happen spontaneously such as congregating in a building to attend a lecture, following a structured timetable, or going to a physical library to do research. The concept of knowledgeability means that ideas about ICT adoption can be observed in the action, elicited from verbal discourses, or deduced from the behaviour of students and lecturers as they engage in education practice. Such knowledge was important for understanding how the adoption of ICTs as tools for education was conceptualised.

This section has demonstrated how Structuration Theory's key concepts of structuration, social structure, agency, reflexivity, knowledgeability, intended or unintended consequences, and acknowledged or unacknowledged behaviours, relate to this study. It was important to consider these key concepts because literature has shown that an action such as adopting ICTs "triggers social dynamics which, in turn, modify or maintain an organization's contours" (Barley, 1986, p. 81). Orlikowski (1992) also argues that ICTs bring with them unanticipated operational changes to an organisation, which may lead to complexities regarding how people perform their duties. It was therefore reasonable to assume that by adopting these Structuration Theory concepts, this study could result in a better explanation of the dynamics of ICT adoption that are implicated in the hidden structures leading to the 2nd order digital divide in the HEI of a developing country. Figure 4.5 provides the major concepts of Structuration Theory.

Figure 4.5 *Data Collection Guiding Concepts*, *Adapted from* (Giddens, 1984)



The concepts presented in Figure 4.5 were adopted to guide the process of collecting and analysing data as well as interpreting the research findings. These concepts included structure, which is composed of rules, relating to norms and culture as well as resources, which regarded allocative or authoritative.

4.7 Conclusion

This chapter discussed the adoption of Structuration Theory as the theoretical basis for this study. While acknowledging the limitations of Structuration Theory, such as the absence of an explicit reference to technology, it was argued that Structuration Theory remained a suitable theory for this research in view of its balanced view of structure and agency, and the use of micro and macro units of analysis as well as quantitative and qualitative data. Chief among the qualities offered by Structuration Theory was the concept of the duality of structure and agency, which afforded the identification of the produced structures that later constrain the adoption of ICTs resulting in a 2nd order digital divide.

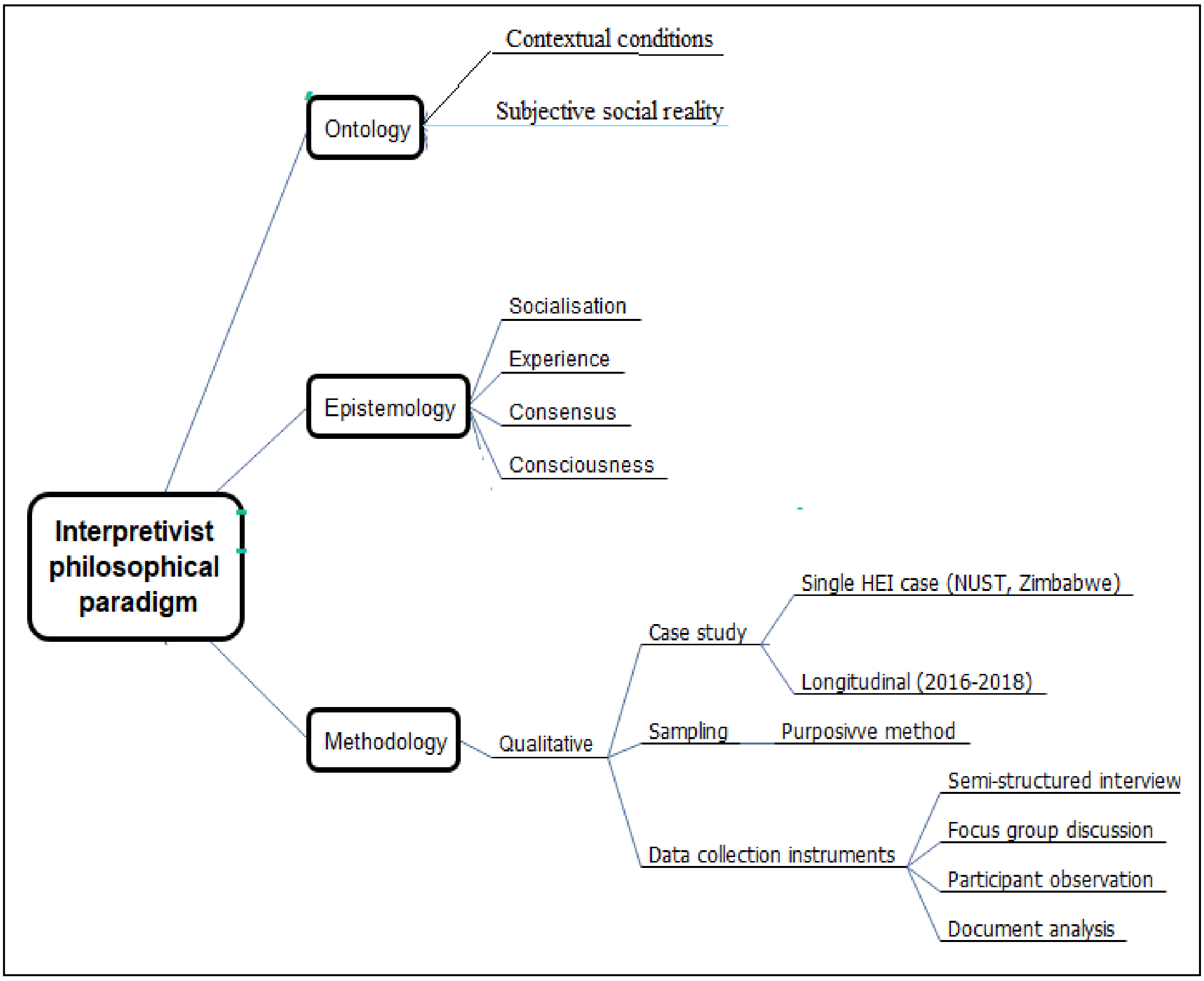
The section on the application of Structuration Theory in similar research demonstrated how the key concepts could be applied in this study to enhance the depth of the explanation of any produced structures that are identified. An understanding of how other scholars have modified Structuration Theory provided an insight into how I could employ Structuration Theory as a foundation for developing a context-specific model for theorising about the 2nd order digital divide phenomenon. The last section demonstrated how the explanatory strength of Structuration Theory concepts will contribute to this study by uncovering both the interlocking dynamics of ICT adoption and the hidden structures that underpin the 2nd order digital divide in the HEI of a developing country. The chapter concluded by emphasising that although Structuration Theory was not the best, its methodological richness was ideal for this study as it is demonstrated in the next chapter on research methodology and data collection.

Chapter 5: Research Methodology and Data Collection

5.1 Introduction

The preceding chapter supported the choice of Structuration Theory as the most suitable alternative theory, offering a methodological richness that was fundamental to providing an insightful explanation of structures leading to the 2nd order digital divide in the HEI case. Figure 5.1 outlines the research and data collection methods discussed in this chapter.

Figure 5.1 *The Concept Map for Chapter 5 (Researcher's own construct)*



The chapter begins with a section that justifies the relevance of the interpretive philosophical assumptions that this study was founded on. The next section demonstrates the importance of collecting rich qualitative data for this study from a single HEI case. This was followed by a section that justifies the rationale of collecting novel data from a small purposive sample of chairmen, lecturers, students, and technicians. The last section illustrates how interviews, focus group discussions, document analysis and participant observations are the most appropriate instruments for collecting novel data to result in deep explanations.

5.2 Research Philosophy

Saunders, Lewis, and Thornhill (2019, p.130) define a research philosophy as "a system of beliefs and assumptions about the development of knowledge". A philosophy is a foundation for generating knowledge in Information Systems studies and in other scientific inquiries (Seale, 1999). Different authors have explained the digital divide problem from different philosophical orientations. In this study, the research philosophy includes the ontological, epistemological, and methodological perspectives of a social inquiry involving the structures leading to the 2nd order digital divide. Each philosophy has its unique assumptions, strategies, methods and limitations, which collectively frame the nature of a scientific inquiry (Chen & Hirschheim, 2004). Positivism, interpretivism and critical realism are popular philosophies for Information Systems research and have all received a widespread attention (Orlikowski & Baroudi, 1991; Walsham, 1993). A brief overview of those three philosophies is given below, to demonstrate why interpretivism emerged as the most appropriate philosophy for this study.

5.2.1 Positivism

A positivist philosophy views scientific knowledge objectively, based on numbers and facts (Walsham, 1995; Lee, & Baskerville, 2003). In a positivist's view, the validity and rigour of a social enquiry is determined by evidence from a reasonable sample of the population. Also central to a positivist study is the generalisability of findings across similar systems or contexts (Klein & Myers, 1999), based on an assumption that the outcome from positivist research is influenced by stable and general laws. This implied that subjective human thoughts or ideas had little or no significance in a positivist social inquiry.

A positivist researcher is therefore an independent observer, with a neutral and objective view of a social reality (Darke, Shanks, & Broadbent, 1998). Positivist research also involves quantifiable observations and statistical analysis (Saunders et al., 2019). This view is confirmed by Orlikowski and Baroudi (1991) who examined Information Systems research according to philosophical perspectives. Their classification concluded that positivist studies emphasise the formulation of representative sampling from a population, collection of quantitative data, recording of quantifiable measures, hypothesis or theory testing, deductive reasoning and generalisable evidence. Lee and Baskerville (2003) summarise that the purpose of a positivist-based scientific enquiry is to discover universal or general laws.

While a survey done by Orlikowski and Baroudi (1991, p. 7) indicated that "much Information Systems research reflects a positivistic orientation", positivism could not fit the purpose of this study for several reasons. First, the descriptive nature of a positivist approach does not provide sufficient depth of understanding for answering research questions that rely on rich data to generate an insightful explanation of structures leading to the 2nd order digital divide. This reasoning is derived from a study by Saunders et al. (2019) who argue that a focus on law-like generalisations usually overlooks the rich insights obtainable from humanity. Second, positivism relies too much on experimental and statistical controls and measurements (Kaplan & Duchond, 1988) and this dependence does not support this enquiry's purpose of providing a rich explanation of structures that lead to the 2nd order digital divide in HEIs within developing countries.

Third, the focus on objectivism that is found in a positivist approach tends to overshadow the subjective reality of the phenomenon being studied (Mingers, Mutch, & Willcocks, 2013). In the present study, a positivist lens could result, in the constructed meanings about structures that lead to the 2nd order digital divide problem being ignored, thus rendering the evidence emerging from the inquiry as limited. Fourth, results from a positivist study are usually descriptive rather than explanatory because of the source and selection of data, and the quantitative methods that are applied (Selwyn, 2012; van Dijk, 2006). Saunders et al. (2019) acknowledge that it is unlikely that quantitative data collection methods could result in a rich explanation of a problem at hand. This implied that if this study were to adopt positivist data collection methods, the results could not lead to the explanatory contribution sought by this research.

The last reason was found in a study by Lee and Baskerville (2003) who observe that the emphasis of positivist research is on statistical sample-based generalisability. A generalisation based on numerical quantities could be unlikely to lead to a novel explanation as it does not account for differences in individual contexts and experiences (Saunders et al., 2019). It can therefore be concluded that the statistical generalisability associated with positivism does not apply to this research, which seeks an in-depth explanation of the structures inherent in the HEI within a specific developing country context with unique conditions and circumstances. The limitations of a positivist philosophy as outlined above, motivated a consideration for critical realism as a foundational philosophy for this study.

5.2.2 Critical Realism

Critical realism is a mid-range paradigm aimed at producing knowledge by leveraging the advantages of both positivism and interpretivism (Wynn & Williams, 2012; Mingers, 2004). Saunders et al. (2019, p.147) contend that "critical realism focuses on explaining what we see and experience, in terms of the underlying structures of reality that shape the observable events". The role of a critical realist is therefore to critique the status quo in order to expose the restrictive and alienating conditions of a social system (Klein & Myers, 1999).

A critical realist researcher seeks to empower people by demystifying myths and "deep-seated, structural contradictions within social systems" (Orlikowski & Baroudi, 1991, p. 6). Borrowing from historical terminology, critical realism aims to decolonise the mind and afford people the right to their own beliefs and values. The main goal of critical realism is to emancipate people from ongoing societal contradictions. A critical realist assumes that “people can consciously act to change their social and economic conditions” (Klein & Myers, 1999, p. 69).

Critical realist research therefore equips people with the knowledge, skills and free will needed to change their livelihoods. Through critical realism, people can develop increased awareness of the constraining laws, resources, and other socially, culturally, and politically oppressive conditions that negatively affect their practices (Klein & Myers, 1999).

Despite the fact that critical realism offers several advantages that could be relevant to this study, the philosophy did not provide a concrete grounding for fully explaining the structures that lead to the 2nd order digital divide problem. Although, critical realism is concerned with uncovering underlying structures leading to phenomena, the underlying philosophical assumptions could not suffice for identifying the interlocking dynamics of ICT adoption, in which the structures of the 2nd order digital divide are manifest. Saunders et al. (2019, p.148) conclude that critical realism depends on “a (mildly) subjectivist approach to knowledge”, implying that the assumptions of critical realism are borrowed from the interpretive philosophy. It was therefore sensible to adopt the interpretive philosophy, which is the source and backbone for critical realism.

5.2.3 Interpretivism

Walsham (1993, p. 6) defines interpretivism as “an epistemological position concerned with the construction, interpretation and experiences of people as they interact with each other and with their social system”. Interpretivists seek to explain social reality from a subjective perspective which afford the research participants an opportunity to contribute to the creation of new knowledge (Lee & Baskerville, 2003). Core to interpretivism are the meanings assigned to the observed phenomenon of interest (Klein & Myers, 1999; Lee & Baskerville, 2003; Walsham, 1995); and the role of an interpretive researcher is to study those meanings (Saunders et al., 2019). The credibility of interpretive research is measured by the evidence of collective consensus obtained from research participants (Walsham, 1995). Saunders et al. (2019, p.149) conclude that the “purpose of interpretive research is to create new, richer understandings and interpretations of social worlds and contexts”.

It was apparent from the preceding discussion that the interpretivist philosophical assumptions aligned well with the purpose of this study for the reasons listed below. First, Dube and Pare (2003) argue that a researcher must avoid being manipulative, obtrusive and too controlling in relation to the research participants. By adhering to this, the subjective meanings revealed by research participants could result in insightful explanations of the structures leading to the 2nd order digital divide problem Second, events leading to a phenomenon of interest could be observed as they unfold naturally (Dube & Pare, 2003; Yin, 1994). This implied that a close engagement and constant interaction with the research subjects could afford an understanding of their constructed, shared meanings, lived experiences and views about the interlocking dynamics of ICT adoption.

Third, qualitative data collection methods are central to interpretive research (Walsham, 2006; Saunders et al., 2019). In the current research study rich data which has been collected through qualitative methods could lead to an insightful explanation of the structures that contribute to the 2nd order digital divide. Fourth, the researcher’s involvement with the research subjects created opportunities for checking with them in order to clarify issues, probe for further explanations, and eliminate contradictions in meanings. This enhanced the credibility (validity) of findings. Furthermore, the interpretive researcher’s close engagement with the research subjects created opportunities for observing structures which cannot be verbally articulated.

Fifth, interpretive researchers develop a close relationship with research informants by working with a small sample of participants (Saunders et al., 2019). This choice was however, made while remaining aware of the potential issues relating to generalisability (Lee & Baskerville, 2003). However, working with a smaller sample could afford the researcher time to interact with the participants in a relaxed environment and to easily conduct follow-up checking and clarification. This could result in high quality, truthful and novel data contributing to in-depth explanations of the hidden structures of the 2nd order digital divide. Finally, literature shows that interpretive research is appropriate for understanding human thought and action within a real-life setting (Klein & Myers, 1999; Orlikowski & Baroudi, 1991). Such an understanding was imperative for identifying the interlocking dynamics of ICT adoption as they unfolded naturally within the HEI case.

The many strengths of interpretive philosophies do not mean that the philosophy's limitations must be overlooked. The main concern is subjectivism, which could compromise the credibility and reliability of findings. Orlikowski and Baroudi (1991) report that interpretive research is usually criticised for reflecting either the researcher's judgement or the participants' understanding. This meant that if caution was not exercised, the findings from interpretive research could reflect bias. Lee and Baskerville (2003) also report that interpretive research's lack of statistical generalisability exposes it to credibility challenges. This was addressed by sampling for heterogeneity and adopting the coherence theory of truth. Saunders et al. (2019), also argue that the subjective narratives and stories that constitute interpretive research are as legitimate as the statistical data found in positivist studies; while, Lee and Baskerville (2003) conclude that the findings from interpretive research are generalisable in other ways beyond statistics. It was with this mindset that the findings of this study could be generalised to support theory development which could be applicable to HEIs with similar circumstances.

Despite these few limitations of interpretive philosophy, this study benefits more from these philosophical assumptions than from the assumptions of the counterpart positivism and critical realism stances. Interpretive research provided thoughtful assumptions for understanding the 2nd order digital divide phenomenon as it was experienced in a natural setting of the HEI case.

Saunders et al. (2019, p.149) emphasise the importance of interpretivism by observing that “different people of different cultural backgrounds, under different circumstances and at different times make different meanings, and so create and experience different social realities”. It was thus concluded that by capitalising on the assumptions of this philosophy’s ontology, epistemology and methodology, insightful outcomes could emerge from this interpretivist study.

5.3 Interpretivist Ontology, Epistemology and Methodology

The interpretivist ontology, epistemology and methodology were key elements of this research. These three key elements related to the known social reality, how that reality became known and through what techniques that reality came to be known. The following sections discussed the interpretivist ontology, epistemology, and methodology in relation to this research which sought to provide an explanation of the structures leading to the 2nd order digital divide in the HEI case.

5.3.1 Interpretive Ontology

An ontology in research refers to the nature of social reality (Saunders et al., 2019). It pertains to the view of the world and what is known to exist in the world. The interpretivist ontology is founded on the premise of a subjective social reality of the world. This interpretive stance is necessary for explaining the causes of the 2nd order digital divide, a phenomenon that cannot be explained objectively through general and stable laws. It was more appropriate to explain this digital divide phenomenon through a conceptualisation of the subjective meanings assigned to the adoption of ICTs as tools for education. The shared meanings about the integration of ICTs in education were valuable for revealing the interlocking dynamics of ICT adoption and the underlying structures behind the 2nd order digital divide phenomenon.

Interpretive ontology supports varied meanings about the same phenomenon and acknowledges that social reality is socially constructed by human beings (Walsham, 2006). In this case, it made sense to assume that the 2nd order digital divide is a product of structures created by the core stakeholders of HEIs. The interpretivist ontology also accounts for the diverse contextual conditions, experiences, history and beliefs that may lead to different views about the same phenomenon (Darke et al., 1998; Chen & Hirschheim, 2004). This ontological stance afforded the establishment of unique contextual circumstances and conditions for the production of structures the 2nd order digital divide is linked to. The interpretive ontology aligned well with the associated epistemology, which was the means of knowing the social reality.

5.3.2 Interpretive Epistemology

Epistemology refers to the process of knowing what is there in the world around us (Walsham, 1995; Saunders et al., 2019). An epistemology provides an explanation of how the existing knowledge was acquired. Epistemologically, interpretivists assume that subjective knowledge about the real world is a result of people's socialisation through language, consciousness, shared meanings, documents, tools, and other artefacts (Chen & Hirschheim, 2004; Klein & Myers, 1999).

This epistemological stance meant that the 'reality' of the dynamics of ICT adoption and the structures leading to the 2nd order digital divide had been socially constructed by lecturers and students, who are the HEI's core stakeholders. These stakeholders' preconceptions, assumptions and beliefs were shaped by the HEI's unique contextual conditions and cultural setting. It was concluded that the interpretivist epistemology was therefore required to identify and explain the structural causes of the 2nd order digital divide. To elucidate such interpretivist epistemological views required engagement of the research subjects through the interpretivist methods of data collection.

5.3.3 Interpretivist Methodology

In a broader sense, a methodology involves but is not limited to the techniques, procedures, methods, and instruments used to collect data necessary for knowing the social reality of what exists in the world. The interpretivist methodology provides a necessary platform for establishing the phenomenon of interest, which exists in the world (Orlikowski & Baroudi, 1991). In this case, an appropriate interpretivist methodology was useful for collecting data about stories, narratives and beliefs regarding the underlying structures that constrain the use of ICTs in education to result in the 2nd order digital divide, a significant problem in HEIs within developing countries.

The interpretivist methodological stance supports multiple data collection methods that can result in a rich explanation of the phenomenon of interest (Dube & Pare, 2003). In this case, interpretivist data collection methods could afford the elicitation of views about the interlocking dynamics of ICT adoption as they unfold within the unique cultural and contextual situation of the HEI case. In summary, conditions and circumstances within this context have an impact on the social ontology, epistemology and methods of data collection used to investigate a phenomenon of interest (Weber, 2004). Employing interpretive philosophical assumptions could result in more insightful explanations of structures leading to the 2nd order digital divide, which was achieved by taking advantage of the multiplicity of perspectives facilitated by multi-pluralist qualitative research methods.

5.4 Qualitative Research Methods

Traditionally, quantitative, qualitative or mixed method approaches are popular for conducting research in Information Systems (Saunders et al., 2019). Quantitative, qualitative, and mixed methods are usually (but not exclusively) associated with the positivist, interpretivist, and critical realist philosophies, respectively. However, van Dijk (2006) argues that qualitative methods are rarely used in digital divide research. This study however, adopted qualitative methods since quantitative methods could not result in data that could fully answer this study’s research questions. Another reason was that quantitative methods usually result in descriptive findings that lack the richness provided by qualitative methods (Bryman, 1984; Chen &

Hirschheim, 2004). A study by Saunders et al. (2019, p.134) argue that quantitative methods are "less likely to offer a rich and complex view of organisational realities, or account for the differences in individual contexts and experiences".

In comparison, qualitative methods afforded the capture of events, actions, norms, values and other data viewed from the perspective of the subjects being studied (Bryman, 1988). Data collected through qualitative methods was valuable for the sense-making about phenomena that it affords (Bowen, 2005; Orlikowski & Baroudi, 1991). Qualitative methods also accounted for differences between individuals and diverse contexts (Saunders et al., 2019). Qualitative methods thus befitted this study because they were compatible with the assumptions of the interpretive philosophy (Bryman, 1984; Seale, 1999; Mingers et al., 2013).

This study adopted qualitative methods to gain an insight into the deeper structures that the 2nd order digital divide is associated with. An understanding of this 2nd order digital divide phenomenon demanded an explanation instead of a simple description. This complex problem could only be explained through agreed-upon rich, subjective meanings, narratives, and stories rather than numerical representations. Such qualitative data afforded the construction of new knowledge rather than the testing of existing knowledge. By employing qualitative methods for this study, it was possible to capture the lived experiences of HEI stakeholders regarding the interlocking dynamics of ICT adoption. The rich qualitative data that emerged resulted in new discoveries of novel, unanticipated and complex structures behind the existence of the 2nd order digital divide phenomenon.

The evidence presented in this section suggested that qualitative research methods were ideal for capturing subjective data that could be used for understanding both the interlocking dynamics of ICT adoption and the structures leading to the 2nd order digital divide in HEIs in developing countries. Yin (1994) makes the important observation that qualitative methods are applicable to a case study research strategy, which is employed in this study.

5.5 Case Study Research Strategy

Yin (1994) defines a case study as an empirical inquiry into a complex phenomenon within its real-life context. Lee and Baskerville (2003, p. 231) emphasise that a “typical and legitimate endeavour in interpretive research is the study of a single setting”. This implied that qualitative data obtained from the narrow scope of a single HEI case was appropriate for affording the construction of the subjective meanings about the phenomenon of interest. A single case study provides a platform for answering the "how" and "why" questions (Yin, 1994). This made it a befitting strategy for this research seeking to explain how and why the 2nd order digital divide persists. Unlike multiple-case studies, a single-case study helps to explain rather than to predict, compare and generalise findings across diverse settings (Darke et al., 1998; Yin, 1994). This single-case study also revealed in depth the underlying issues relating to the 2nd order digital divide phenomenon under study.

Adopting a case study strategy could afford the observation of the events leading to the 2nd order digital divide as they unfolded naturally. The corresponding constructed meanings could result in an insightful explanation of the structural causes of the 2nd order digital divide, as the lived experiences of lecturers and students expose the interlinking dynamics of ICT adoption.

Yin (1994) identifies two approaches to data collection within case study research, namely the cross-sectional and longitudinal approaches. Cross-sectional data collection is a once-off activity, while longitudinal data collection occurs over a prolonged time frame. Data for this study was collected longitudinally over a three-year period from 2016 to 2018. This was an appropriate approach for understanding the dynamics of this complex phenomenon (Bryman, 1984; Ngwenyama & Nielsen, 2013). Dube and Pare (2003) argue that data which is collected longitudinally tends to result in rich explanations. Chen and Hirschheim (2004) confirm that an elongated data collection time frame provides ample time to observe patterns of behaviour as they evolve over time. In this case, the extended time frame was significant for tracking any new developments or changes in the status quo of ICT adoption. The longitudinal process resulted in a richer understanding of ICT-supported educational developments and changes that took place within the study period. This section has thus justified the adoption of a single HEI National University of Science and Technology (NUST) where data was collected over a longer period of time to result in insightful results.

5.5.1 Case Description

NUST)is situated in Bulawayo province and is the second oldest of the 10 state universities in Zimbabwe, a developing country in Southern Africa. Zimbabwe is a land-locked country covering a surface area of 390,757 km² (World Food Programme, 2017) and shares borders with Zambia, Mozambique, Namibia, South Africa and Botswana as shown in Figure 5.2.

Figure 5.2 *Map of Zimbabwe*

Zimbabwe is divided into ten provinces and several districts (IIEP Pôle de Dakar - UNESCO, 2016). The country has a population of about 15.6 million people, 67% of whom dwell in rural areas and depend on subsistence farming for livelihood (World Economic Forum, 2017; DFAT, 2016). Although there are several indigenous languages, English is the official language (DFAT, 2016). Despite the fact that Zimbabwe was previously regarded as a bread basket of Southern Africa, the country is currently faced with severe economic hardships and high rate of poverty, disease and unemployment (World Food Programme, 2017; SARC Department, 2013; DFAT, 2016).

Despite these challenges, higher education has a special place in Zimbabwe. This education stance aligns with literature, which shows that higher education is the gateway to development (Zhu & Chen, 2013; Sarwade, Jadhav & Gade, 2014). The important role of higher education in Zimbabwe is evident in the expansion of HEIs from a single university in 1980 to 20 HEIs at the time of conducting this study. These HEIs include technical colleges, polytechnic colleges, teacher-training colleges, and other vocational skills training centres (Shafika, 2007). The country's high literacy rate of about 92% could be attributed to this emphasis on education. The high demand for higher education in Zimbabwe has however, led to new problems related to shortages of learning spaces, learning material and expert educators. ICTs have become important and relevant tools for addressing these problems (Morley, Leach & Lugg, 2009; Ekundayo & Ekundayo, 2009); and NUST was the first HEI in Zimbabwe to be specifically tasked with promoting the adoption of ICTs as tools for supporting education.

5.5.2 NUST, the HEI Case Site

NUST, which is located in Bulawayo as is shown in Figure 5.2 became operational in 1991 with an enrolment of fewer than 300 students. Since then, there has been a substantial increase in student enrolment, the staff compliment, and the number of departments and faculties. In 2016, NUST had 7 faculties, 33 departments, about 400 teaching staff members and above 9000 students. The academic year is divided into two semesters, each of which is 12 weeks long, and students may be enrolled on either a full-time or a part-time basis.

Degree programmes average four years for undergraduates and two-years for a taught Masters. The few doctoral degree programmes do not have a stipulated time frame. Lectures and tutorials follow a structured timetable and are on average two-hours long. Each course is allocated four hours of teaching and learning time per week totalling 48 and 56 hours per semester for undergraduate degrees and taught Masters degrees respectively. Students register for at least 12 courses in each academic year, which should all be passed. Any failed courses need to be re-taken. Table 5.1 shows the grading system for courses.

Table 5.1 *Grading System.*

Academic level	Mark range (%)	Grade
Undergraduate degree	0-49	Fail
	50-59	Pass
	60-64	2.2
	65-74	2.1
	75-100	1
Taught Masters degree	0-49	Fail
	50-59	Pass
	60-69	Credit
	70-79	Merit
	80-100	Distinction

ICT developments at NUST include the establishment of faculty computer labs, equipped with desktop computers, printers, projectors, Internet connectivity and LMS facilitated e-learning systems. The MOODLE LMS was implemented in the early 2000s followed by Sakai LMS in 2012 and by Google Classroom in 2016.

Although NUST is not the only HEI with an established e-learning system in place, I chose it for this study for the following reasons. First, NUST is the only HEI that follows an exclusive Science, Technology, Engineering and Mathematics (STEM) programme. Second, NUST's vision is to provide industry with technically savvy human resources. Third, NUST has a manageable (small) population of about 400 lecturers and 9000 students. Finally, NUST was easily accessible to me as I am a permanent staff member at NUST with more than a decade of lecturing experience at the institution.

This vast experience has increased the researcher's familiarity with NUST's educational activities, contextual conditions, educational culture, and other social practices. It was worth capitalising on that familiarity to conduct this research. While being careful to remain non-manipulative, unobtrusive, and non-controlling, the researcher could take advantage of the experience and proximity to NUST to search for structures constraining the adoption of ICTs. These two aspects facilitated the identification of participants who could provide truthful and credible information.

Literature supports this decision by showing that using a familiar case study enables a researcher to "construe, conceptualize, and understand events, concepts, and categories" valuable to that case (Kaplan & Duchon, 1988, p. 572). From this familiar context, I could easily observe salient structures that could not be articulated verbatim, but which are important for explaining the 2^{nd} order digital divide problem. This approach is emphasised in Structuration Theory's concept of knowledge derived from practical consciousness and unconsciousness (Giddens, 1984; Lyytinen & Ngwenyama, 1992).

The researcher's long-term involvement with NUST also afforded the realisation that ICTs had not yet become mainstream, since educational practices at NUST are still dominated by traditional face-to-face (f2f) methods except for students who are mandated by their course curriculum to use computers such as those doing Computer Science who are shown in Figure 5.3. This observation is consistent with literature showing that there is a low usage of ICTs at many HEIs in Zimbabwe (Chitanana et al., 2008; Dube & Scott, 2014; Khumalo & Baloyi, 2018). I also realised that the level of ICT adoption at NUST remains low in comparison with world-wide trends where, higher education is being transformed towards virtual classes and Electronic Resources (e-resources) (Morley, Leach & Lugg, 2009; Ekundayo & Ekundayo, 2009). This technological lag has resulted in a 2nd order digital divide problem. The researcher, therefore engaged with a small purposive sample of research participants to gain an insight into the structural causes, of this 2nd order digital divide.

Figure 5.3 *Use of Personal Laptops by Final Year Computer Science Students*

5.5.3 Purposive Sampling

It was necessary to define the sample size for this study prior to specifying the data collection techniques. Bowen (2005) emphasises that qualitative research, which stresses an in-depth investigation of the phenomenon of interest, uses purposive sampling as opposed to random sampling. In this case, the samples of lecturers and students were purposively drawn from the two faculties of Applied Science and Industrial Technology, while the samples of technicians and chairmen were drawn from across all seven faculties.

Although the Faculty of Science and Technology Education was an appropriate entity for sampling it was not possible to include students and lecturers from this faculty because it is dominated by block-release programmes. Students in this mode of education usually function under strict time-constraints that could prevent them from participating in a prolonged study of this nature. The Faculty of Medicine was also excluded from the study due to its physical location, which is distant from the university's main campus and presented access challenges. Although the Faculty of Commerce has high numbers of students and lecturers, programmes that are offered by this faculty are not supportive of the STEM initiative. Table 5.2 illustrates the distribution of the research participants.

Table 5.2 *Distribution of the Research Participants*

Participants	Target population	Sample size
Chairmen (Head of school / department)	33	14
Teaching staff members	16	12
Technical staff members	8	6
Students	160	149
Total	**217**	**181**

In Table 5.2 the data showed that the target population included 33 chairmen representing 33 departments, in which they administer the academic activities, and 16 lecturers representing 16 departments from the selected faculties of Applied Science (11) and Industrial Technology (five). There are seven faculties, responsible for a computer lab that is manned by a chief technician giving a total of seven chief technicians; and there is also a special department responsible for e-learning, which is the responsibility of an additional chief technician. The combined total of seven faculty chief technicians plus one e-learning chief technician resulted in a target population of eight technical staff members. The variance between the target population and the actual sample size could be attributed to various reasons, chief among them being the busy schedule of potential participants and a lack of interest in participating in the study. The final sample had 181 participants.

The researcher worked with this small sample while aware of potential criticism relating to generalisability issues. This choice was however informed by Lee and Baskerville (2003) who argue that although an increase in the sample size may sometimes lead to an increase in reliability and/or validity, it does not imply greater generalisability. The decision to use a relatively small sample was also based on the need for easy management, access, and willingness to participate. Furthermore, in interpretivist research, numbers are not as important as the quality of the collected data. Despite the small sample, there was a fair representation of lecturers and students who Kundi et al. (2010) consider to be the core stakeholders of HEIs.

With the research sample of participants established, what remained was to describe the data collection instruments that were used, including semi-structured interviews, focus group discussions, participant observation and document analysis.

5.6 Data Collection Instruments

Bowen (2005) identifies four instruments that are widely used for the collection of qualitative data: semi-structured interviews, focus group discussions, participant observations and document analysis. These data collection instruments afford a free platform for research participants to share their insightful lived experiences (Bryman, 1984). Darke et al. (1998) contend that when a variety of data collection instruments are used, information from different research participants can be validated and contradictions in narratives can be analysed for further deliberations. Literature also shows that research based on multiple and varied data sources can result in rich findings (Dube & Pare, 2003). Bryman (1988, p. 47).acknowledges that a variety of techniques “allows inferences or ‘leads’ drawn from one data source to be corroborated or followed up by another”. Based on this complementary mindset, this present study employed the four widely used qualitative data collection instruments outlined below and the data was collected longitudinally from January 2016 to December 2018.

5.6.1 Semi-Structured Interviews

While different types of interview are available, the semi-structured approach was chosen as the primary source of data for this study because it results in in-depth, rich, and insightful explanations. Three groups of research participants were interviewed, namely lecturers, chairmen and technicians. Bowen (2005) argues that an interview guide is vital for organising and analysing interview data. Based on this perspective, the researcher developed an interview guide for all the categories of research participants. Although the interview guide contained structured questions to keep the participants focussed, there was room for emergent and follow-up questions during the interview session.

Semi-structured interviews were conducted face-to-face to establish a close relationship with the interviewees, building trust while at the same time assessing the correspondence of spoken words and the accompanying body language for follow-up questioning. The appropriateness of this data collection instrument was informed by Richardson (2011, p. 13) who argues that "without the voice of the end user, we fail to understand the unique needs of the person as well as the community".

The researcher set aside the initial 3-5 minutes of each interview session for introductions, and for providing an overview of the study, its purpose, and expected achievements. The researcher also used this opportunity to emphasise confidentiality, anonymity, voluntary participation, and the option to withdraw at any point, and to share the ethical approval documents. The researcher then utilised this time to ask for permission to record the conversation on a voice recorder. The audio recordings of interviews saved me time and enable me to verify the accuracy of collected data. The researcher used pseudonyms for all the recordings of interviewees for later referencing, which put the interviewees at ease and encouraged them to speak freely without fear of identity disclosure. All interview sessions were conducted in English and were guided by Structuration Theory's concept that are depicted in Figure 4.5. Table 5.3 lists the 12 lecturers who voluntarily participated in this research, and includes their sample ID, details of their accessible ICT devices, and their department and gender.

Table 5.3 *The Interview Participants: Lecturers*

Interviews over 2 Semesters (February – December 2016) *The Interview Participant: Lecturers (L)*			
ID	**Accessible ICT devices**	**Department**	**Faculty**
L001	Personal laptop, smartphone, and desktop	Computer Science	Applied Science
L002	Personal laptop and Smartphone	Applied Biology and Biochemistry	Applied Science
L003	Smartphone and institutional desktop computer.	Applied Chemistry	Applied Science
L004	Smartphone and personal laptop	Applied Mathematics	Applied Science
L005	Tablet PC, personal laptop, and smartphone	Applied Physics	Applied Science
L006	Digital camera, smartphone, and laptop	Computer Science	Applied Science
L007	Desktop computer, smartphone, personal laptop	Industrial & Manufacturing Engineering	Engineering
L008	Smartphone and personal laptop	Forest Resources & Wildlife Management	Applied Science
L009	Smartphone and personal laptop.	Sports \Science and Coaching	Applied Science
L010	Smartphone.	Statistics & Operations Research	Applied Science
L011	Smartphone and personal laptop.	Chemical Engineering	Engineering
L012	Smartphone and personal laptop.	Environmental Sciences & Health	Applied Science

The content of Table 5.3 is organised into four columns where "L" in the first column refers to Lecturer. Reflected in Table 5.3 are the 12 lecturers who were interviewed, and the different interviews were conducted in the lecturers' offices and occurred over two semesters between

February and December 2016. Prior to each interview, the researcher scheduled an appointment via telephone and a convenient date and time for the interview was set with the willing participant. Each interview session lasted between 45 and 60 minutes. The sample questions and responses were shown in Appendix E, which notably focussed on e-learning, the core online mode that is dependent on other ICT devices and infrastructure for functionality.

Further interviews were conducted with the technical staff members after an oral consent was granted. The interviews were conducted in their respective offices following a structured guideline. The interview sessions averaged 60 minutes due to disturbances from lecturers and students seeking technical assistance. Table 5.4 lists the technicians who participated in the study, and reflects their sample ID, characterised by "T" regarding the Technician and Faculty.

Table 5.4 *The Interview Participants: Technical Staff Members*

The Interview Participants: Technicians(T)	
ID	**Faculty**
T001	Faculty of Applied Science
T002	Faculty of Commerce
T003	Faculty of Built Environment
T004	Faculty of Communication & Information Science
T005	Faculty of Engineering
T006	ICTs (online platforms)

Table 5.4 includes six technicians who were drawn from five faculties plus a special department responsible for e-learning systems. The Faculty of Science and Technology Education and the Faculty of Medicine were not represented since they do not have faculty-level computer labs. The interview guideline and sample responses are included in Appendix F.

The last category of interviewees was the departmental chairmen, who head each department and are responsible for the administration of those departments. The appointment bookings for the interviews were done orally through the telephone. Table 5.5 is organised into three columns where “C” in the first column relates to Chairmen. The contents of Table 5.5 show that some participants preferred not to record their department, resulting in several 'Unspecified' entries in the Department column.

Table 5.5 *The Interview Participants: Chairmen*

The Interview Participants: Chairmen (C)	
ID	**Department**
C001	Unspecified
C002	Science, Mathematics & Technology Education
C003	Art, Design and Technology Education
C004	Unspecified
C005	Unspecified
C006	Fibre & Polymer Materials Engineering
C007	Computer Science
C008-C013	Unspecified
C014	Surgery

The data reflected in Table 5.5 shows an unequal distribution of participants by gender, since the participating chairmen included ten males and only four females. After appointments had been scheduled by telephone, the individual interviews were conducted, these averaged only 30 minutes due to time restrictions that resulted from the administrative commitments of the chairmen. A sample of interview questions and sample responses were included in this thesis as Appendix G.

As before, pseudonyms were used to identify the recorded interviews for analysis purposes. To complement the data that emerged from interviews, focus group discussions were conducted with a group of students.

5.6.2 Focus Group Discussions

Students are the core stakeholders of HEIs, because without them there could be no clientele for HEIs (Mapuva, 2009). Their participation in this study was necessary as it provided an insight into students' beliefs, lived experiences, concerns, challenges and priorities with regard to adopting ICTs as tools to support learning. A focus group discussion provided an environment in which students could engage openly while saving the researcher time. Bryman (1988) defines focus group discussion as a form of unstructured interview involving many subjects concurrently.

One hundred and forty-nine students participated in this research, all of whom were enrolled for degree programmes offered in the faculties of Applied Science and Industrial Technology. The students were divided into 14 groups based on their departments. The same cohorts participated twice in this research, first in 2016 when they were in their 2nd year of study and again in 2018 when they were in their final year following a year-long internship period. This was an appropriate cohort because in their second year (as opposed to their first year of study) they had become familiar with institutional education practices. Their internship period also exposed them to enablers and constraints of learning through ICTs since they were physically located away from the HEI campus. The narratives of students about their ICT experiences within and off campus were expected to provide significant information for explaining the interlocking dynamics of ICT adoption and the related structures leading to the 2nd order digital divide in this HEI case. This method was also important as it enabled the researcher to establish how the students construed their learning environment with or without ICTs.

The participants were asked to reflect on their ICT experiences, challenges, opportunities, and priorities before, during and after the year-long internship. This was done in order to establish the existence of any new developments or changes in the students' ICT experiences, their perceptions about ICT-enabled education, their constraints in using ICTs, and their recommendations on how to proceed towards an effective adoption of ICTs in education. Table 5.6 lists the groups from the faculties of Applied Science and Industrial Technology that participated in the study.

Table 5.6 *The Focus Group Discussion Population Sample*

Group discussions over two academic years: 2015/2016 and 2017/2018 *The Discussion Participants: Students (FG)*		
Faculty	**Department**	**Focus group ID**
Applied Science	Computer Science	FG001
	Computer Science	FG002
	Forest Resources & Wildlife Management	FG003
	Applied Biology and Biochemistry	FG004
	Sports Science and Coaching	FG005
	Statistics and Operations Research	FG006
	Applied Chemistry	FG007
	Environmental Sciences & Health	FG008
	Informatics	FG013
	Applied Physics	FG010
Engineering	Fibre & Polymer Materials Engineering	FG009
	Electronics Engineering	FG011
	Civil & Water Engineering	FG012
	Industrial & Manufacturing Engineering	FG014

As in the case with interviews, each focus group discussion began with a few minutes of introduction where the researcher explained the purpose of the discussion, emphasising confidentiality, anonymity, voluntary participation, and the option to withdraw at any point if desired. The researcher also encouraged active participation from all the group members. Each discussion lasted between 60 and 90 minutes and was recorded on a voice recorder for future referencing.

Focus group discussion was an appropriate technique as it made it easy for both the coherences and the contradictions of the participants' responses to be quickly revealed (Bryman, 1988). Focus group discussions are also a flexible method of data collection since the discussion is loose and unstructured. The biggest problem encountered during the focus group discussions was that some participants were too vocal and overshadowed other participants' contributions preventing the collection of more varied data. Some group members were also reluctant to participate, which converted the discussion into a form resembling an interview session.

Despite these problems, the focus group discussion led to interesting insights that could not have been captured from interview participants. The key topics leading the discussions and a sample of responses were included in this thesis as Appendix H. Interviews and focus group discussions were further complemented by data obtained from participant observations, which occurred concurrently with the interviews and focus group discussions.

5.6.3 Participant Observations

Participant observation is the ability to view the world from the perspectives of closely monitored research participants (Bryman, 1984). Participant observation "entails the sustained immersion of the researcher among those whom he or she seeks to study with a view to generating a rounded, in-depth account of the group, organization, or whatever" (Bryman, 1988, p. 45). As part of the observation process I attended a randomly sampled selection of lectures and tutorials, having first sought permission from the responsible authorities to be part of these activities. Similar observations continued throughout the three years from 2016 to 2018. This approach allowed the researcher to get first-hand information about how lectures and tutorials were conducted, including ICT activities, the behaviour of students and lecturers, and the contextual conditions of the classrooms (among other important observations). Through this technique a researcher can “construct a qualitative contextual picture of a certain situation or a flow of events” (Bryman, 1984, p. 81). From the observed activities the researcher was able to discern the interlocking dynamics of ICT adoption and the structures leading to the 2nd order digital divide problem. It was also interesting to note how students congregated around areas served by WI-FI routers to access the scarce Internet.

Through this method, the researcher familiarised with a variety of teaching, learning and research activities and the environment in which these activities took place. Through the researcher’s immersion in the HEI context, the researcher was able to determine the setup of the lecture rooms, accessible Internet access points, working computers in the computer laboratories, access to the library’s hard copy and electronic resources, lecture sessions and other observable features of the HEI. This was a convenient method of discerning how the corresponding educational activities unfolded.

Since the previously discussed interviews took place in the interviewees’ offices, the researcher had an opportunity to observe the environment and conditions of those offices. The researcher also observed the computer labs after conducting interviews with the technicians. During this time, the researcher inspected the layout of computers, their cabling, the accessible power sockets, and anything else that caught the researcher’s interest; the researcher sampled the available software and the ease of downloading software and information from the Internet; and the researcher observed how students interacted with the various computer devices, systems and tools available in the computer labs. The researcher also had an opportunity to move around and observe the students’ online activities. This was aimed at establishing whether students were using those resources in acknowledged behaviours with intended consequences.

Since focus group discussions were conducted in the students' lecture rooms or computer labs, this afforded the researcher an opportunity to observe not only the set-up of the room, but also the activities of those students who were not participating in the focus group discussion and who remained in the room during the discussions. Such observations enhanced the data obtained from interviews and discussions.

Through participant observations, the researcher was able to acquire data that could have been hard to obtain through interviews and focus group discussions. Such data related to the condition of ICT infrastructure including the accessibility of desktop computers, and usable ethernet cables, the availability of working Internet access points, methods of lecture delivery, and student assessment, and other modes of teaching and learning. This was a useful technique for validating the credibility of the data that emerged from interviews and discussions. These observations were further strengthened by an analysis of the HEI documentation.

5.6.4 Document Analysis

Document analysis was conducted on samples of meaningful written material that were identified within the case site. These ranged from the minutes of meetings, and electronic mails, to policy documents, manuals, and reports, among other documents. Document analysis is a very flexible way of collecting data since documents are highly portable and can be analysed independent of the case site location. There were a few documents that were only accessible within NUST such as the institutional ERP and the Sakai LMS documentation. These were analysed while at the case site other documents were analysed from home or while travelling. All the reviewed documents were coded for further analysis.

Additional information pertaining to student enrolment, staff complements, faculties, departments, research activities and degree programmes was obtained by analysing content on the university website, and the library website was a useful source of information relating to accessible e-resources. Sakai LMS and Google-Classroom systems were analysed to determine the types of activity, frequency, and student participation levels on those e-learning platforms. To evaluate the usefulness and ease of using those two platforms, an analysis and comparison of courses was conducted on both Sakai and Google-Classroom every semester from 2016 and 2018.

The draft of NUST's ICT policy document which available on the intranet as well as being recorded in minutes from the ICT committee was also analysed. Internal electronic mail broadcasts also afforded me the opportunity to identify any invitations to participate in the training programmes designed to support ICT-enabled education. The intention behind analysing these institutional documents was to identify the challenges being faced in the adoption of ICTs as tools for supporting education.

Using these four data collection instruments afforded me an opportunity to capture truthfully reported first-hand experiences, including quotations from actual conversations held with and between the participants. By collecting empirical data for this study through afore-mentioned data collection instruments, afforded the research rigour to be achieved as is demonstrated in the following section.

5.7 Research rigour

Rigour is an important aspect of any research undertaking, and research that is rigorously conducted is easily accepted by the community of researchers. Rigour is conceptualised in the literature as reflecting the quality of the research findings, which is achieved through the presentation of credible, dependable, confirmable and transferable findings (Krefting, 1991). The claim for rigour in this research was based on the suggestion by Gregor (2006) that rigorous research can also be achieved through the integration of multiple sources of evidence. Table 5.7 illustrates how this qualitative study satisfied the requirement for research rigour by emphasising the credibility of results based on the employment of reliable methods for collecting data from multiple relevant sources drawn from a purposive sample of participants.

Such an approach is important for dealing with the problem of bias, which may easily be introduced when qualitative research is conducted (Darke, Shanks, & Broadbent, 1998).

Table 5.7 *Qualitative Case Study Rigour Criteria*

Criterion	**Guidelines from literature**	**How the guidelines were fulfilled in this study**
Credibility (aka validity)	Presentation of accurate descriptions and interpretations	This was achieved by conducting member checking where the research participants were followed up for clarity of information and also conducted an informant *triangulation.*
Dependability (aka reliability)	Methods including triangulation and coding procedure	*Multiple data collection methods, like focus group discussions, document analysis, interviews, and participant observations* were used. The researcher then *coded data transcripts* to provide a systematic explanation and a coherent description of findings.
Confirmability	Triangulation of data sources on a longitudinal case study	Multiple interviews with *multiple HEI stakeholders* (14 chairmen, 12 lecturers and six technicians) and discussions with 14 groups of students from 13 departments and two faculties were conducted. *Documentary evidence* from minutes of meetings, emails, website, student portal, policy documents. First-hand information from *participant observations* of the HEI and its practices. the data for the study was collected over a three-year period
Transferability (aka generalisability)	Applying sampling logic	*Sampling for heterogeneity* technique where participants were purposively drawn from two STEM oriented faculties of a single HEI case was employed.

‘aka- also known as

The entire data collection process with a focus on achieving research rigour was guided by the ethical standards that should be observed when dealing with human subjects, particularly students, in order to prevent harm and to avoid exposing or violating the privacy concerns of the research participants.

5.8 Ethical Consideration

Ethical issues are of prime importance in research because, if not careful, a researcher might disclose confidential information, invade the research participants' privacy, or even harm the participants. "Informed consent is certainly an important feature of ethical considerations in any research involving human subjects" (Bowen, 2005, p. 214). Based on this perspective, the researcher sought ethical clearance from the registrar's office at NUST prior to commencing the study. The application for consent to undertake a study at NUST was prepared according to the procedure suggested by Darke et al. (1998), which involves seeking written consent to conduct this research at the institution.

In the application the researcher explicitly indicated the purpose of the study and the ethical considerations to be observed. The researcher also implemented the suggestion by Bowen (2005) that a brief description of the study, its procedures and the researcher's identity should be included in the application for research consent. The application for consent was subsequently approved, and the researcher was granted permission to publish the findings for scholarly purposes. Both the application and the approval letter have been included in this thesis as Appendix I and Appendix J.

The researcher also adhered to the regulations of the host university where she was studying, which required me to complete and sign an Ethics in Research Application Form. The researcher then submitted this form, which was approved by the relevant office as indicated in Appendix K. Despite most researchers' willingness to abide by all the rules governing research ethics, literature shows that the diversity of ethical concerns may render it impossible to honour and resolve them all (Walsham, 2006). In this research the researcher was very conscious of the need to provide "an assurance that participation is voluntary and that the respondent has the right to withdraw at any time without penalty; an assurance of confidentiality; and benefits and risks associated with participation in the study" (Bowen, 2005, p. 214) at all times. Having collected the research data and considered all relevant ethical issues, the next step was to prepare the collected data for analysis. The preparation process is discussed in the next chapter.

5.9 Conclusion

This chapter provided a detailed discussion of the research methodology and data collection methods employed in this study. To address the methodological gap highlighted in the literature review in Chapter 3, this chapter presented an argument for adopting the philosophical assumptions that are inherent in interpretivism. The researcher demonstrated how the interpretivist ontology, epistemology and methodology could afford the construction of subjective meanings about the adoption of ICTs in higher education.

The researcher proceeded to justify the adoption of qualitative methods for collecting rich data to support the development of insightful and in-depth explanations of the underlying structures that contribute to the 2nd order digital divide phenomenon in the HEI case. This was followed by a rationale of why the collection of data from a single HEI case over a prolonged time frame could enable the hidden structures behind the 2nd order digital divide to unfold naturally within the real-life setting of that HEI case.

The researcher concluded the chapter by highlighting the appropriateness of interviews, focus group discussions, participant observations and document analysis as vehicles for sense-making and for understanding the lived experiences of a relatively small sample of participants. This discussion paved the way for the analysis of the empirical data that was collected and the reporting of preliminary findings, which is outlined in the next chapter.

Chapter 6: Data Analysis

6.1 Introduction

The previous chapters reported the results of a literature-based survey, which supported the premise that the 2nd order digital divide is a problematic phenomenon in HEIs within developing countries. The researcher also indicated that despite attempts to explain the causes of this phenomenon, a gap still exists with regard to understanding the structures that contribute to this 2nd order digital divide problem in HEIs particularly within developing countries. Guided by Structuration Theory, qualitative data was collected from 181 participants including departmental chairmen, lecturers, students, and ICT technical staff members, drawn from a single HEI (NUST), which is the second oldest university in Zimbabwe.

This chapter presents the findings from the preliminary analysis of empirical data. The initial section of the chapter introduces two popular approaches used for qualitative data analysis-thematic analysis and content analysis. This was followed by a justification for the choice of directed content analysis as an appropriate method for this research. In the sections that follow, the three stages of a directed content analysis (preparation, organising and reporting) are discussed. Findings from a preliminary analysis are presented in the form of conceptual maps created using NVIVO 12, a software application used for analysing qualitative data. The chapter concludes with a reference to four themes that emerged from the empirical data, which were discussed in more detail in the next chapter.

6.2 Data Analysis Process

Thematic and content analysis are two-well-known approaches used for qualitative data analysis. Braun and Clarke (2006) suggest that thematic analysis is more appropriate for studies that seek to develop a theory, model or framework from data collected and inferred through an inductive logic approach. These authors further contend that the purpose of a thematic analysis is to identify, analyse and report patterns (themes) within data.

Although thematic analysis has several advantages, it also presented numerous challenges for achieving the goal of this research. The first challenge related to the process of identifying themes in thematic analysis. Drawing from literature, Vaismoradi, Turunen, and Bondas (2013) report that in thematic analysis, themes are generally very abstract, which makes it challenging to identify them. That could be likely to present difficulties for this research which seeks to identify explicit structures that contribute to the problem of the 2nd order digital divide. The second challenge derived from Braun and Clarke (2006) was that themes are subjective in nature and their identification depends on how relevant they appear to the researcher. This again would not suite the objective of this study, because credibility (validity) and dependability (reliability) are fundamental for explaining the structural causes of the 2nd order digital divide.

The third challenge was that a thematic analysis process considers both manifest (textual) and latent (symbolic meanings) content (Braun & Clarke, 2006). Such an approach would not suffice for this study, which would not base the explanation of the causal structures on implicit latent content associated with varied and vague meanings. Last, the researcher found the process of constructing a thematic map to be less important for this study where relationships among data could easily be presented through mind maps, matrix frameworks, cluster and explore diagrams, supported by in-built features provided by NVIVO.

6.3 Content Analysis

Content analysis is concerned with analysing content through the application of both the deductive and inductive reasoning approaches. Hsieh and Shannon (2005) identify three types of content analysis: conventional, directed, and summative. Conventional content analysis is mostly employed in studies using grounded theory, which seek to inductively derive code categories from raw data. In directed content analysis, code categories are deductively derived from either an existing theory or research findings. In summative content analysis words from manifest content are first counted, after which the analysis is extended to include latent meanings and themes (Braun & Clarke, 2006). In this context, manifest content refers to content that is explicit in the text of empirical data while latent content refers to implicit meanings that are not clearly expressed in a textual form, such as a sigh, laugh, exclamation or frown, among other non-verbal cues.

In this study, directed content analysis was employed to analyse the empirical data in accordance with the key concepts of Giddens' Structuration Theory. This afforded the researcher the opportunity to demonstrate how the 2nd order digital divide emerges from the duality of social structures with the human agency. Structuration Theory was used as a sensitising device for analysing the structures that rely on human agency but also constrain the human agency, and which contribute to the 2nd order digital divide. Directed content analysis also provided a platform for establishing consensus on the constructed meanings that relate to structures which constrain the uptake of ICTs in education leading to the 2nd order digital divide in the HEI of a developing country. Vaismoradi et al. (2013) argue that in content analysis the importance of a theme depends on quantifiable measures. This ability to conceptualise themes made it possible to identify emergent themes relating to the structures that cause the 2nd order digital divide and was an attractive quality of content analysis.

Although summative content analysis considers both manifest and latent content, the focus of this study was on analysing manifest data since manifest content is explicit in the research participants' discourses. The researcher purposively avoided analysing latent content as that could have led to incorrect assumptions based on vague interpretations of latent content (Braun & Clarke, 2006). For instance, while it is common to 'tear' (i.e., to cry) when in pain, in some cultures, people tear to demonstrate their excitement. To avoid such misinterpretation, the researcher chose to rely on analysing content that was explicitly reported verbally by participants, written down on the institutional documents or observable in the institutional culture, values, habits and norms.

Elo and Kyngas (2008) defined three phases of content analysis, which are the preparation, organising and reporting phases. The collected empirical data was analysed according to these phases, which are described in some detail in the following sections.

6.4 Phases of Content Analysis

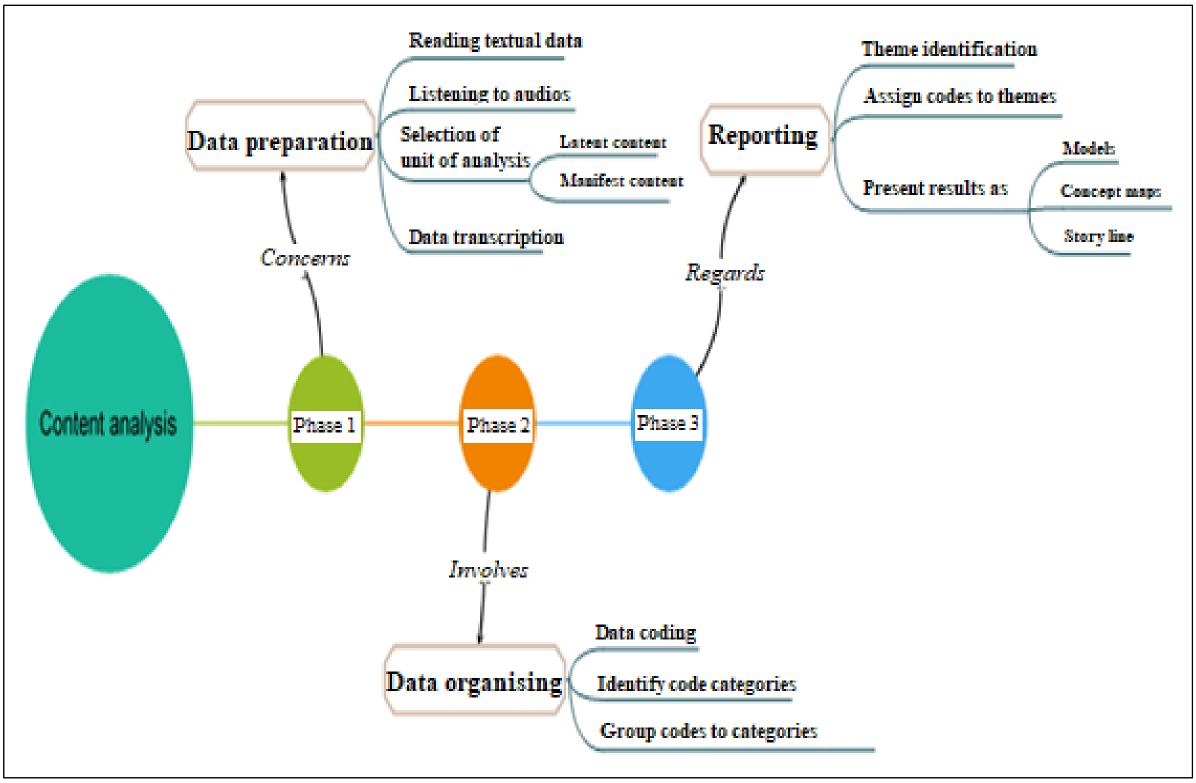
The three phases of content analysis defined by Elo and Kyngas (2008) are presented in Table 6.1.

Table 6.1 *Phases of Content Analysis (Source: Elo & Kyngas, 2008)*

Phase	Description
Preparation	This involves *transcribing* data (if necessary), *reading* and re reading the data and noting *initial ideas.* Also selecting the *unit of analysis* and deciding on the analysis of *manifest content or latent content.*
Organising	*This concerns coding* interesting features of the data in a systematic fashion across the entire data set and *collating data* relevant to each code. Also, o*pen coding* and creating *categories; grouping codes* under higher order headings; and formulating a general *description* of the research topic.
Reporting	Here, *codes are collated* into potential *themes*, gathering all data relevant to each potential theme. Also r*eporting* the analysis process and results through *models, conceptual systems, conceptual maps or categories, and a story line*.

It is apparent from Table 6.1 that the preparation phase involves data transcription, based on the reading through of written text and/or listening to audio recorded data. The goal was to identify the main ideas, select the unit of analysis and direct the analysis focus towards either manifest or latent content. The organising phase involves the identification of codes, coding, categorising codes and relating them to the research topic. The reporting phase concerns the identification of potential themes, classifying codes into themes and mapping results into a coherent story. Figure 6.1 depicts a graphical representation of the three main phases of a directed content analysis. Detailed descriptions of each phase are presented in the subsequent sections.

Figure 6.1 *Phases of a Directed Content Analysis Approach*



6.4.1 Data Preparation Phase

The data preparation phase concerns the formatting of the data and getting it ready for analysis. Braun and Clarke (2006) regard this as a phase where the researcher becomes familiar with the collected data. This phase involves gaining an understanding of the collected data through listening to audio recordings, reading through the textual data, transcribing, and formatting data.

The researcher listened to 46 audio recordings to identify data that were relevant to the predefined codes listed in the code book that she had created prior to data collection. In the second stage of phase one, the researcher read through, the textual data contained in the institutional documents, particularly the minutes from the meetings held in the ICTs department, and minutes from the Faculties of Applied Science and Industrial Technology. The researcher further read through relevant electronic mails that were shared via the intranet and then searched for related data from the policy documents, institutional web site and portal. Lastly, the researcher read through field notes that the researcher had written during participant observations, interviews and focus group discussions.

Listening to audio recordings and reading through textual data enabled me to familiarise myself with the data in preparation for transcription. During transcription, the audio recorded data was transformed into textual data by typing the contents on the relevant platform on NVIVO 12, a software application used for qualitative data analysis. After that, the transcripts were copied from NVIVO 12 into Microsoft (MS) Word editor for formatting.

The formatting process involved assigning appropriate heading styles to interviewee and interviewer data for easy analysis. For example, the researcher assigned the heading style "1" to all the interview and focus group identifiers like "FG001" while the actual responses were assigned the "normal" heading style. This separated identifiers from the actual responses making it easy to code the actual responses while excluding the identifiers (which could otherwise have become outliers skewing the analysis results). Finally, all the formatted transcripts were exported back into NVIVO 12 in preparation for coding. The researcher also used the in-built NVIVO NCAPTURE feature to transcribe images and web pages in preparation for coding.

Elo and Kyngas, (2008) observe the role of auto-coding in identifying useful units of analysis, which is valuable for making decisions regarding the type of content to analyse. Based on this perspective, the researcher auto-coded all 46 formatted transcripts based on the number of the research participants to result in the initial high-level codes, using a specific name like "FG001" to reflect the participants in the first focus group. This was followed by the creation of 46 specific cases organised into appropriate case classifications of lecturers, students, chairmen and technicians. At this stage, the formatted data transcripts were ready for organising.

6.4.2 Data Organising Phase

This phase involved identifying low-level data codes, deriving code categories based on Structuration Theory guidelines, and mapping codes into the identified code categories. In the initial stage of this phase the researcher coded data from the 46 formatted transcripts, which yielded 64 initial codes. The researcher then proceeded to derive three code categories based on Giddens' Structuration Theory. Depicted in Table 6.2 are the three theory-derived code categories, which were organised as key theoretical concepts with accompanying definitions.

Table 6.2 *Theory-Derived Code Categories (Source: Giddens, 1984)*

Key theoretical concepts	Definitions
Social structures	Refers to a set of generative rules and resources that humans draw upon and change as they act to produce social systems.
Rules	These are techniques and procedures that guide the production of social practices within a social system.
Resources	This regards the generative power to command the allocation of material resources and the authoritative power to control the activities of human resources.

Table 6.2 summarises the three key concepts derived from Structuration Theory: social structures, rules, and resources. Social structures are a combination of rules and resources. Rules are the guidelines for using resources, which include material and human resources necessary for producing social structures. Table 6.3 shows a sample of the codes used in this research mapped against Gidden's concepts (Table 6.2).

Table 6.3 *Sample Codes in a Code Book*

Category	Code	Description
Social structures	Communication	Strategies for conveying ICTs for adoption
	Planning	Preparations for finances, infrastructure etc
	Support	Management and technical support
	Motivation	Incentives, empowerment, training, workload
Rules	Policy	Guidelines for using ICTs
	Business procedures	Guidelines for using ICTs
Resources	Connectivity	WI-FI, Internet, ethernet cables
	Security (cyber)	Lecture rooms, libraries and computer labs
	Computing resources	Desktops, laptops, projectors etc
	ICT infrastructure	Hardware, software, systems and consumables
	Electricity	Source of power for use with devices
	Time	Moment to learn and use ICTs
	Security (physical)	For protecting physical devices and data

The sample of codes in Table 6.3 were mapped to code categories that were derived from Structuration Theory through a deductive reasoning process. Inductive reasoning was employed as a follow-up approach to identify any interesting data that could not be mapped to the theory-based code categories. Such invisible but salient data was coded and mapped to an additional code category that were named “Unassigned”. From this point onwards, the code category “Unassigned” was used to represent the codes that could not be mapped to theory-driven code categories. A sample of low-level codes that emerged from open coding and were mapped to the “Unassigned” category are depicted in Table 6.4; these included issues such as usability, security, complexity, compatibility, and credibility.

Table 6.4 *Sample Codes under the "Unassigned" Code Category*

Code	Description
Usability	Ease of using ICT artefacts
Complexity	Perceived difficulty of using ICT artefacts
Compatibility	The feeling that ICTs are isolated
Academic freedom	Academic restrictions following ICT adoption
Credibility	Reliability of adopting ICTs

The process of identifying, naming and mapping the individual codes is an aspect of the reporting phase of content analysis, which the researcher introduced in the following section and describe in more detail in the next chapter.

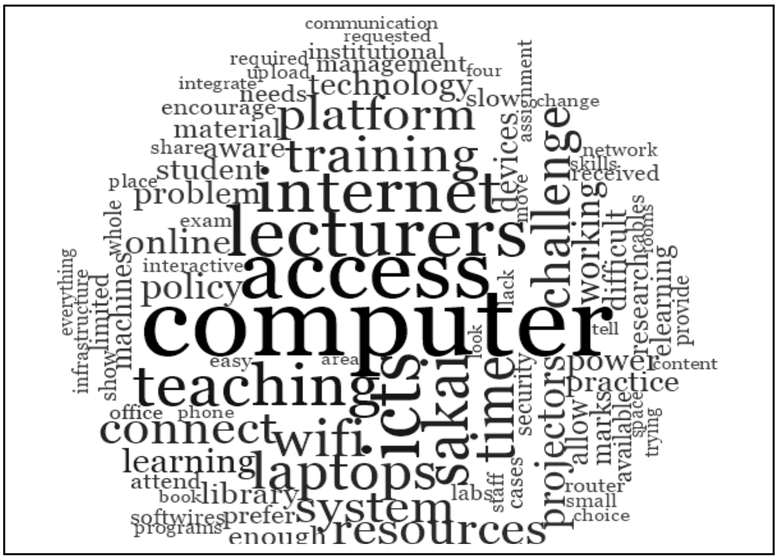
6.4.3 Reporting of Findings Phase

This was the final phase of directed content analysis and involves identifying themes, collating codes into potential themes, and grouping all similarly coded data for reporting within a relevant theme. The process begins with thorough scrutiny and testing of the empirical data for consistency, before identifying, naming, and mapping codes to themes, and then finally applying the coding rules to the entire corpus of text. The results that emerge from the empirical data during this reporting phase are presented in the form of models, conceptual maps, or frameworks, or as a story line.

The entire data set was considered for the purpose of reporting the results of the analysis. From this, particularly vivid and compelling extracts were selected to provide supporting evidence for answering the research questions. Although a detailed report was provided in the next chapter, it is worth presenting an overview of the preliminary findings in this chapter. The first stage was to analyse the word frequency by counting the number of times a word was referenced.

Figure 6.2 depicts a word cloud as an output of querying the data for mostly referenced 100 words of four or more letters. Such words as computers, access, Internet, WI-FI, teaching, lecturers, training, time, resources were frequently referenced by the participants. It could be concluded that the recurrence of these words reflects the participants' concerns regarding the adoption of ICTs.

Figure 6.2 *Inclusive Cases Word Cloud (own construct informed by theory)*



The frequently mentioned words illustrated in the word cloud in Figure 6.2 are represented by the codes depicted in Figure 6.3, which is a cluster diagram showing the underlying causes of concern regarding the adoption of ICTs. These causes have been identified by codes and were clustered based on the underlying Pearson correlation coefficients. Figure 6.3 was followed by the corresponding map of code relationships shown in Figure 6.4 and Appendix L.

Figure 6.3 *A Cluster Diagram of the Identified Causes (own construct informed by data*)

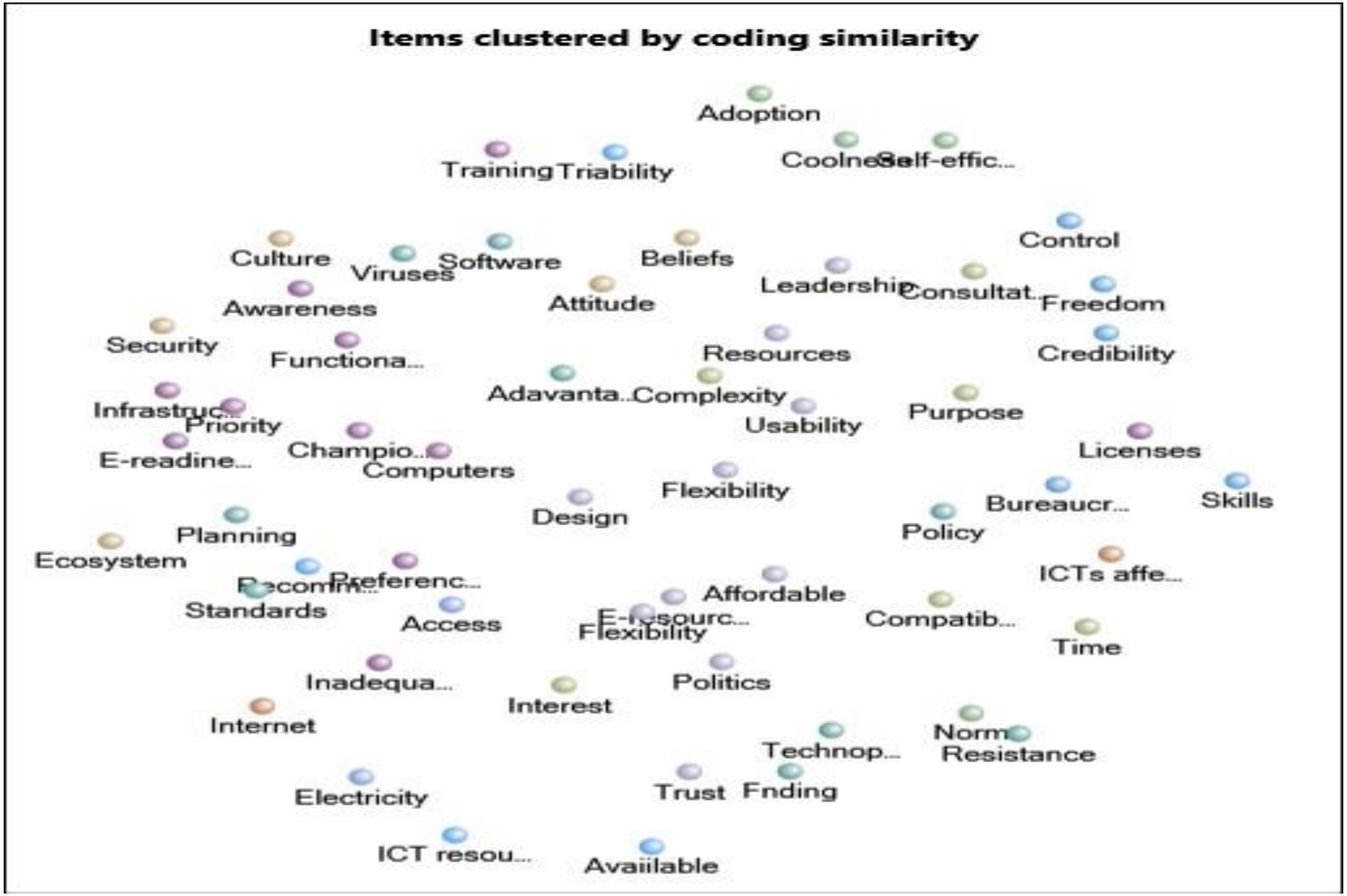
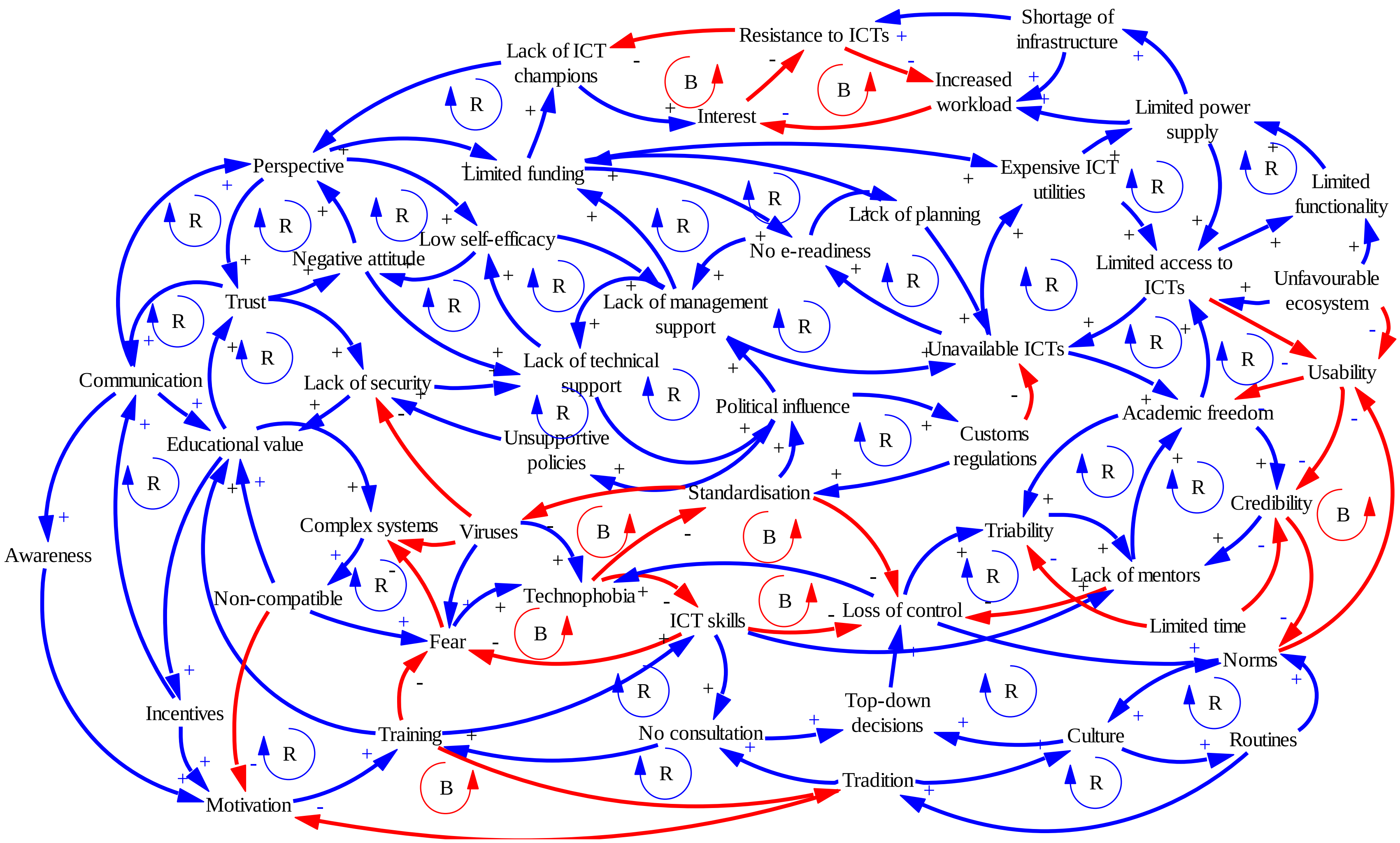


Figure 6.4 *Influence Diagram for the Identified Causes of the 2nd Order Digital Divide*



While Figure 6.3 depicts a noisy presentation of empirical data, which lacks a systematic order, Figure 6.4 is difficult to understand due to the messy interconnections between the data items. This prompted the researcher to subject the empirical data and codes to further interpretive analysis. Walsham (1995) argues that the credibility of interpretive research is measured by the evidence of collective consensus obtained from research participants while Vaismoradi et al. (2013) contend that in content analysis the importance of a theme depends on quantifiable measures. Based on these perspectives, the researcher employed a word frequency feature in NVIVO to search for emergent themes by querying the empirical data for words with high code counts and grouped by specialisation and code categories with many codes.

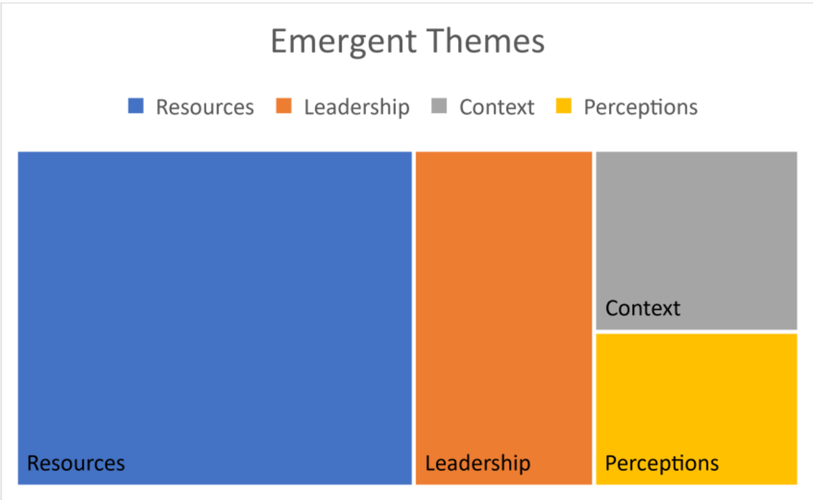
The results of the query are depicted in Table 6.5, illustrating the six words with the highest frequency counts and code counts. Resources topped the list in both categories, with a word frequency count of 506 and with 15 codes grouped under the category name. Leadership was next with a word frequency count of 229 and ten codes grouped under the category name. Context followed with a frequency count of 141 and nine codes. Perception had a frequency count of 128 and seven codes. Skills had a frequency count of 120 and no codes while Availability had a frequency count of 100 and six codes.

Table 6.5 *Frequently Referenced Codes*

Word	Count	Similar words	# of codes
Resources	506	equipment, furniture, inventory, investing, resource	15
Leadership	229	direction, funding, instruction, maintain, represent	10
Context	141	culture, innovations, institution, tradition	9
Perceptions	128	discourage, reluctant, reluctant, resist, uptake, utilise	7
Skills	120	practice, proficient, technique	0
Availability	100	avails, usable	6

The researcher then consolidated the words by including skills within perceptions and including availability within resources resulting in four words that represent the emergent themes. The four themes were named Resources (in blue) and the most prominent regards all material resources), Leadership (in brown) represent the capacity to lead, Context (in grey) refers to the HEI's situation and Perceptions (in yellow) (regards the psychological make-up of human resources), as shown in Figure 6.5. Appendix M shows the matrix framework of the four themes which are discussed in more detail in the next chapter.

Figure 6.5 *Emergent Themes from Empirical Data*



6.5 Conclusion

This chapter reported preliminary findings from the analysis of empirical data, which was guided by the principles of directed content analysis. The initial section introduced thematic and content analysis as the two popular methods of qualitative data analysis. This was followed by an overview of three types of content analysis: conventional, directed, and summative. The method of directed content analysis was identified as being most appropriate for this study, and the three phases of data preparation, organising and reporting were discussed. In the last section, four emergent themes were identified: Resources, Leadership, Context, and Perceptions. These themes are discussed in more detail in the next chapter.

Chapter 7: Findings from Empirical Analysis

7.1 Introduction

The previous chapter presented preliminary results obtained from the analysis of this study's empirical data and concluded by referring to four emergent themes. This chapter reports on the findings that emerged from more detailed analysis of the empirical data. The chapter begins by presenting and discussing the empirical data supporting the four emergent themes of Resources, Leadership, Context and Perceptions. The next section reports on the identified signification, domination, legitimation, belief, institutional and governance structures that were found to contribute to the 2nd order digital divide in the HEI case. The chapter conclusion refers to the interlocking dynamics of ICT from which the structures that lead to the 2nd order digital divide were manifested. These interlocking dynamics of ICT adoption are detailed in the next chapter, which presents the theoretical elaboration of the empirical data that was obtained during this study.

7.2 Emergent Themes from Empirical Data

At the conclusion of the previous chapter, the researcher described how the four themes emerged from the study's empirical data. This process included the categorisation of all codes associated with similar patterns into common broad themes that were representative of each set of associated codes. For example, Resources focussed on all material resources necessary for using ICTs. Leadership involved all codes relating to HEI management activities, which either enable or constrain ICT adoption. Context included the internal and external societal conditions within which ICTs are to be adopted. Perceptions included codes relating to users' perceptions about institutional ICTs. These emergent themes were explained in subsequent sections.

7.2.1 Resources

Literature indicates that the operations of a modern organisation depend on resources (Lazarević & Lukić, 2016). The resources referred to in this study consist of ICTs and the infrastructure that facilitate the use of ICTs such as telecommunication systems, electricity, venues, and computer laboratories. Empirical analysis revealed that resources were scarce, as demonstrated in the following comments: "*some departments struggle to find chairs to sit on*" [FG002]; "*sometimes lectures are conducted in the computer labs*" [FG009]; "*The library is too small and has few computers*" [FG008]. Scarcity was mentioned in discourses about the unavailability, inaccessibility, and unaffordability of resources.

Unavailability of Resources

The narratives of study participants show that resources were not readily available within the HEI, as was evident from the following sample quotes: "w*e do not have a dedicated computer lab but we use a faculty lab with limited computers and is assigned to all the students from part one to part five, so it is always full"* [FG009]; *"there are monitors with big stomachs that are not even working but just junk*" [FG002]; "*I was not given a computer at my recruitment*" [L007].

Table 7.1 lists additional evidence about the unavailability of resources, including ICT systems, electricity, venues, and other related equipment. These concerns were included in comments that read, "*projectors are not enough there is only one projector that is working properly*" [FG008]; "*I am not utilising technology because there is no technology"* [L009]; "*WI-FI inside the rooms is weak*" [FG003]; "*there is electricity challenges and limited power backup facilities which is not powerful enough to cover the whole campus*" [C007]; "*our computer lab lacks ICT infrastructure to support learning and research*" [FG001]; "*a faculty lab is being used for lectures because there is no learning space*" [L009]; "*students struggle to find chairs to sit on*" [FG002]; "*Sockets are a challenge for us and there is no balance of the square and round sockets*" [FG014].

Table 7.1 *ICT Resource Unavailability*

Resource	Source	Data extract
ICT resources	[FG001]	The *computer labs are not adequately equipped.*
	[FG013]	*There are no ethernet cables in the labs.*
	[T002]	*Projectors are not enough so we allocate them through booking.*
ICT systems	[FG002]	No *intelligent e-learning systems* that *can understand learners.*
	[L001]	At its best *Sakai focusses on summative assessments* and there is *no feature for formative assessments* expected in technical courses.
Electricity	[C006]	*We have challenges of electricity power interruptions and outages during which we do not get back up generator power.*
	[FG011]	*Problem is of power outages which in turn impact on the downtime of Internet services.*
Venues and computer labs	[FG002]	*We still have incomplete lecture rooms and computer labs are not enough.*
	[FG005]	*We are short of rooms and as you can see, we are learning from a corridor.*
	[FG004]	*We are short of facilities; the library is still under construction.*
Equipment	[FG008]	*There is only one type of sockets which are square so for us with round plugs it is not possible to recharge our laptops without having to incur an extra cost of buying the adapter.*
	[FG013]	*The library is too small and has a limited sitting space, power sockets and chairs.*

These findings are consistent with existing literature, which relates the use of ICTs to the availability of resources (Govender & Chitanana, 2016; Njenga, 2018; Kisanjara et al., 2019). It could be concluded that the unavailability of resources was partly linked to the unaffordability of costly resources, which is discussed in the next section.

Unaffordability of Resources

Although the cost of ICT resources like desktop computers and smart phones has reduced, their maintenance costs are still high. Research participants were concerned about the unaffordability of resources, as observed in the following comments: "*some learners do not have laptops"* [L002]; "*we can't force them (students) to go and buy computers because some of them can't even afford to pay full fees so we can't add that burden on them"* [L009]; "*for one to use e-learning there is need for WI-FI and it's not everyone who has it at home"* [FG012]. Data bundles are also out of reach for many; for example, at the time of data collection, a home basic broadband package of 10 Gigabytes cost ZWD26, 200, equivalent to USD262 at the time of this research. Lecturers also experience challenges of resource unaffordability, as evidenced in comments by [L007] and [L010] who acknowledged that they were failing to replace their old laptops due to a lack of funding.

These findings are confirmed by existing literature, which shows that the high cost of ICT acquisitions and maintenance is affecting the usage of ICTs, particularly in developing countries (Tedre et al., 2010; James, 2008; Gyamf, 2005). The unaffordability of ICT resources further negatively affects the accessibility of resources such as WI-FI.

Inaccessibility of Resources

The analysis of empirical data also revealed a problem of resource inaccessibility. Several participants confirmed this observation with comments like: "*you can only access Sakai LMS within and not outside the NUST network but the network is always down*" [L002]; "*whenever more than 20 students try to take the test or quizzes at the same time the Sakai software crushes*" [T005]; "*currently you can't even connect to the Internet while in this lab where there is a router, you have to be near or under the router to connect*"[FG004]; "*in our office right now we must open the door or go outside to get a nice WI-FI connectivity*" [L008]. These observations are further confirmed in the comments below:

> *The other day I found the other members hanging around the entrance and when I asked them what's going on they said this is where you can get WI-FI by this entrance. I don't*

even try WI-FI here because it goes I think as far as that door that's why people go and hang out by that door [L009].

WI-FI at NUST accommodates a certain number when it reaches that number it kicks every other device out and the access points carry 10Mbs and so if there are 100 or 200 people accessing the Internet via the same access point, it makes the Internet to be very slow [FG002].

Table 7.2 presents a list of available ICT resources together with details of related elements or aspects that are not accessible to users. It is apparent from this list that many ICT resources which could make a valuable contribution to teaching, learning and research are not accessible. For example, NUST lacks the state-of-the-art computing devices, alternative power supplies, strong WI-FI signals and power socket diversity that are needed to support reliable Internet connectivity.

Table 7.2 *Resource Availability versus Non-Accessibility*

Available	Desirable ICTs
Few WI-FI access points	Antivirus software
Outdated e-resources	Updated e-journals
Computer labs with desktop computers & Cathode Ray Tubes (CRTs)	State-of-the art computers
Personal laptops and mobile phones	Emerging technologies for education
Google-Classroom & Sakai LMS	MOOCs software
Slow Internet connectivity	Stable student WI-FI services
Weak WI-FI signal	Strong WI-FI signal
Congested bandwidth	Campus-wide access points
Expensive and unstable electricity power	Generator and solar power
Traditional classrooms and libraries	Virtual classes and libraries
Simple projectors	Interactive whiteboards
Malfunctioning ethernet cables	Working ethernet cables

These findings are not unique to NUST. Pelgrum (2001) reported almost two decades ago that the adoption of ICTs in education is constrained by a lack of access to resources. This view is echoed in more recent literature showing that HEIs, particularly in developing countries, experience challenges of ICT resource inaccessibility (Muyinda et al., 2019; Dube, 2017a; Kisanjara et al., 2019; (Nantongo & Hetland, 2020).

The preceding discussion has provided empirical evidence that within the context of this research study, the resources that are available for supporting ICT adoption are inadequate, unaffordable, and difficult to access. Such challenges could be attributed to the HEI leadership who are responsible for the acquisition and allocation of educational resources.

7.2.2 Leadership

In the literature the term leadership is usually associated with the act of guiding organisational activities towards the attainment of a common goal (Analoui, Doloriert, & Sambrook, 2013; Sarker & Lee, 2003). Table 7.3 summarises the characteristics of three common leadership styles: transformational, transactional, and laissez-faire (Avolio, Bass, & Jung, 1999).

Transformational leaders lead by example; are influential and, considerate, they stimulate and motivate followers towards a common goal. Transactional leaders employ the “do as I say” principle in order to ensure that followers comply with the set standards of the organisation. A laissez-faire (French for "leave to do") leadership style refers to a hands-off leader who allows followers to make their own decisions and trusts them to get the work done.

Table 7.3 *Dimensions of Leadership Styles (Source: Avolio, Bass, & Jung, 1999)*

Style	Dimension	Definition of the dimension
Transformational	Idealised influence	Leaders' influence is displayed through trust, ethical and moral conduct, which is persuasive, mentoring and encouraging.
	Individual consideration	Leaders delegate duties but are cognisant of followers' needs and concerns; they stimulate, coach, and teach their followers.
	Intellectual stimulation	Empowers followers to develop skills for growth based on innovativeness, creativity and problem solving.
	Inspirational motivation	Involves use of motivation and training strategies to inspire others towards good performance.
Transactional	Contingent rewards	Remuneration and recognition of outcomes achieved by followers are key to this leadership style.
	Management by exception	Emphasises standards for compliance, and corrective measures for ineffective performance by followers.
Laissez-faire	Invisible	A form of weak leadership and responsibility avoidance.

One might expect HEI leaders to instigate ICT adoption through mentoring practices involving lecturers and students. On the contrary, the findings from this study's empirical data revealed that the HEI case was dominated by a laissez-faire leadership style, which is evident from the following comments: "*use of ICTs is not a standard its by choice*" [L003]; "*Well it depends on the individual lecturers some feel more comfortable using ICTs while others prefer traditional means of teaching*" [C014]; "*the use of the projector depends with the lecturer*" [FG007]; "*use of online platforms depends with lecturers because we last used Sakai platform when we were in part 2*" [FG014]; "*currently the computers are not used appropriately because there is no limit on what to access so some students occupy computers to access social networks like Facebook and Instagram*" [FG003]. These comments confirm that ICT adoption was voluntary. Table 7.4 identifies aspects of leadership style that were either present or absent within the HEI case.

Table 7.4 *Leadership Aspects Observed in the HEI Case (Source: empirical data)*

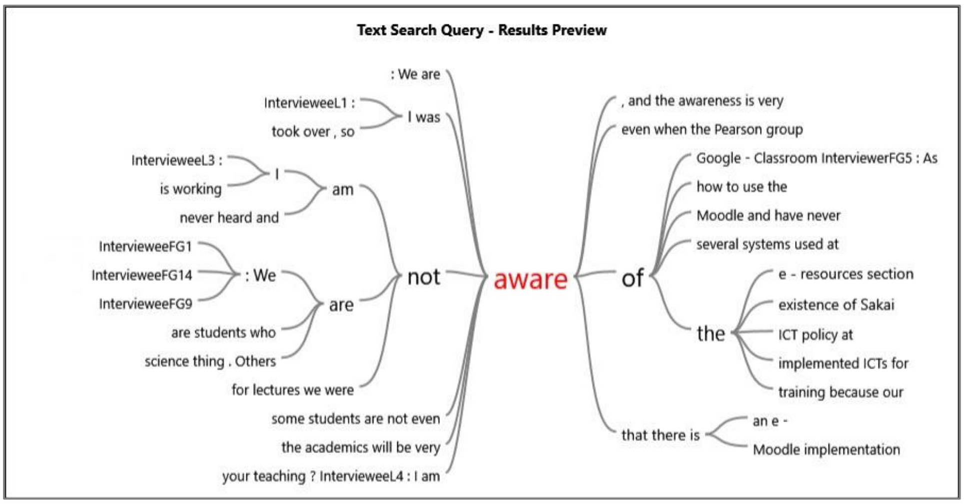
Leadership style	Present	Desired
Transformational	Bureaucracy	Consultation
	Top-down decision making	Motivation strategies
		Training / orientation
		ICT awareness / skills development
		ICT champions / mentors
Transactional	Risk avoidance	Rewards
	Culture of non-ICT use	Recognition
		ICT / BYOD policy
		ICT use standards / goals/ guidelines
		ICT use compliance framework
Laissez-faire	Voluntary use of ICTs	ICT champions

These empirical findings are consistent with existing literature, which argues that the successful adoption of ICTs depends on a strong and committed leadership (Analoui et al., 2013; Sarker & Lee, 2003). In the context of education, Keengwe, Kidd, & Kyei-Blankson (2009) found that lecturers who integrated ICTs in their teaching practice were inspired to do so by their leaders. In this study's empirical data, leadership was mentioned in discourses involving ICT awareness, training, planning, support, consultation, and funding. Evidence relating to this was provided in discussions on each of these leadership traits that are presented in the subsequent sections.

ICT Awareness

Many participants claimed that they were not aware of some of the existing educational ICTs, as depicted in the word tree in Figure 7.1. Only members from the departments of Computer Science, Statistics and Operations Research, Biology and Industrial Technology indicated awareness and appreciation of their departmental chairpersons who are championing ICT usage.

Figure 7.1 *Lack of ICT Awareness (NVIVO generated from data)*



When Figure 7.1 is read from left to right, it results in comments like, "*we are not aware of Google-Classroom", "I am not aware of the existence of Sakai LMS", "we are not aware that there is a MOODLE implementation", "some students are not even aware of the e-resources section"*, "*I am not aware that there is an eLearning system"*. Additional evidence to support these claims is illustrated in Figure 7.2, which compares ICT awareness with the intention to adopt ICTs in educational practices.

Figure 7.2 *ICT Awareness and ICT-Based Method*

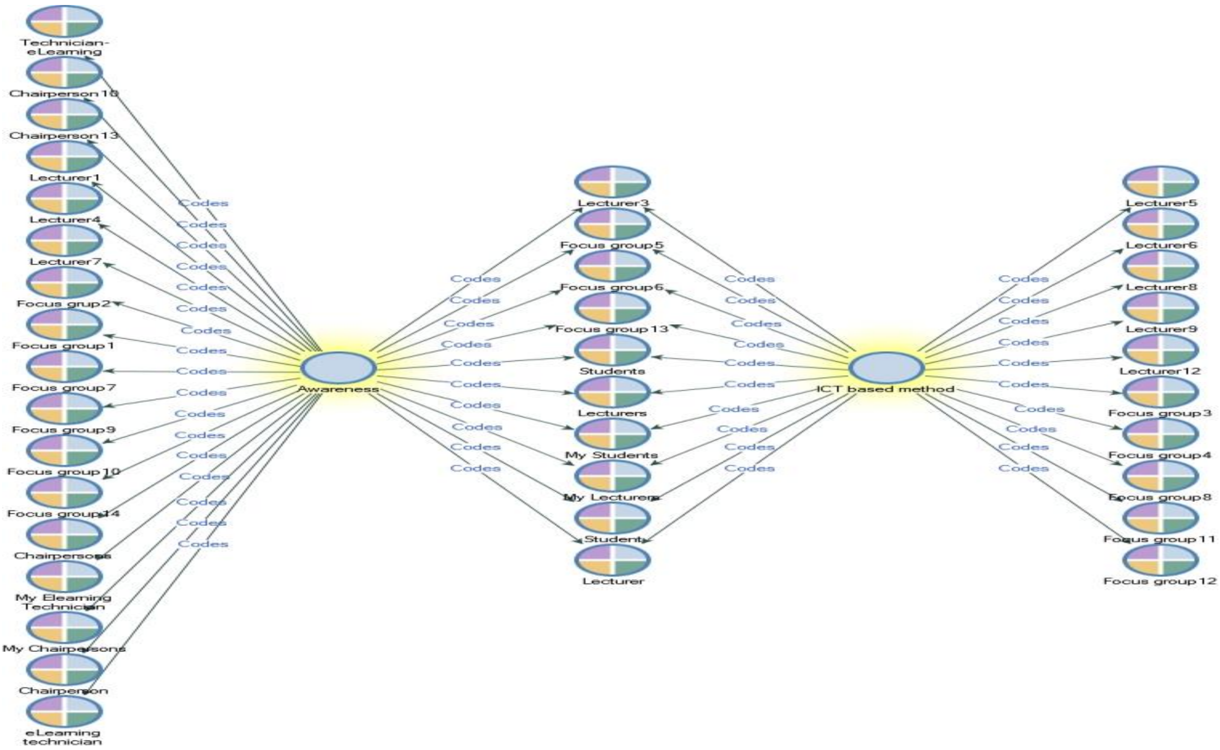


Figure 7.2 was important for presenting a visual form of the level of ICT awareness as proclaimed by the research participants within the HEI case. When read from left to right, the comparison diagram in Figure 7.2 reveals that there are many cases of participants who were aware of the implemented ICTs for education. Nevertheless, it was just a minority of these participants who are both aware and are engaging such ICTs in the education process while the majority of the participants who proclaimed to be aware of the existing ICTs, did not adopt them. For example, narratives of students read, "*we are aware of the existence of Sakai but have never used it*" [FG013]; and "*although we are aware of the google docs, we haven't used it yet*" [FG011]. A group of students who were aware of an ICT resource claimed that "*we don't like sakai anymore we just leave it there we don't care about it anymore*" [FG004].

The general feeling among research participants was that HEI leaders have not done much towards improving awareness about existing ICTs. This was evident in comments regarding student orientation and lecturer induction programmes, which did not include any ICTs. For example, discussions with a group of students revealed that "*we have never used Google-Classroom because no one ever oriented us on the system*" FG004]; "*I have never heard and am not aware of Google-Classroom*" [FG005]; "*we were not aware of the online platforms till recently when we saw other students using them*" [FG012]; "*We are not aware of the e-resources*" [FG014]. The exceptions of ICT awareness are reported by Dube and Scott (2017b), such as the awareness of the Google Classroom, software used for uploading course material and assignments, YouTube tutorials as well as Google Docs for document collaboration.

Literature emphasises the need to create awareness of the existence of ICTs prior to adopting them (Kisanjara et al., 2019; Njenga, 2018; Govender & Chitanana, 2016). Macredie and Mijinyawa (2011) also refer to a lack of awareness: not of the ICTs themselves, but of how to use those ICTs. Training was therefore implicated in ICT adoption, and the development of a training strategy would be an option for improving adoption. However, these data extracts point to deeper issues of training beyond the simple awareness of ICTs.

Training

The empirical findings also revealed serious challenges associated with training, as is demonstrated by the differing views of trainers and trainees. The trainees (students and lecturers) argued that the delivery of training by the appointed trainers (technicians) left a lot to be desired.

The study's empirical data revealed that 27 of 46 cases claimed that they were not trained to use Sakai or Google-Classroom, the two e-learning systems currently implemented at the HEI. Several participants commented that, "*we did not receive any training on the online platforms"* [FG012] "*there is a lack of training and if people don't know how to use the ICTs, they tend to shun them*" [L004]; "*no training was held by the training dept"* [C008]; "*we know the name but we don't know how to use Google-Classroom*" [FG007]; "*we did not get formal training on how to use the Sakai online platform*" [FG009]. Paradoxically, appendices N through Q provide evidence of the invitations to training, which were broadcast on the intranet of the HEI; and even I attended a couple of training sessions.

The observations that were revealed in empirical data about training are supported by literature, which emphasises the importance of skills development and training prior to ICT adoption (Kisanjara et al., 2019; Govender & Chitanana, 2016; Cox et al., 1999). Empirical analysis further revealed that successful training hinges on the presence of management support and commitment as discussed in the next section.

Support and Commitment

The empirical analysis of the data also revealed that there was poor management support and a lack of commitment towards the implemented ICTs. For example, [L001] indicated that there are no incentives for being innovative. Comments by [L006] and [L010] confirmed that there are no rewards for integrating ICTs in education. Concerns were also expressed that while students try to bridge the ICT resource gap by bringing their own devices, the HEI's management provides no security mechanisms to safeguard students' devices from theft [FG004].

The general feeling among students and lecturers was that management support was lacking. Several participants also identified limitations in technical support, stating that "*it took forever to get any technical help that is if it is provided at all*" [L005]; "*when you request for help from the ICT technical staff they rarely come*" [L012]; "*it takes for ever to get ICT resources for use. such thinking is what is causing a drawback, or anything related to technology*" [FG002]. Such statements implied that technical support was hampered by bureaucracy and a lack of prioritising of ICTs.

A lack of consultation and user involvement also enhanced concerns about leadership. The findings from this study confirmed results reported in the literature, which show that management support and commitment are central to the adoption of ICTs (Hong et al., 2011; Noguera, 2015; Zanamwe et al., 2013).

Consultation and User Involvement

The analysis of empirical data emerging from this HEI case suggests that the leadership approach was characterised by insufficient consultation and user involvement. Decisions about ICT implementation and use appeared to have been made following a top-down approach. This was evident in the comments like: "*it is important to concertize your users before implementing your new system*" [C001]; "*the management has a big role to play regarding the use of ICTs at NUST as they need to consult us prior to bringing any ICTs*" [C006] and "*I was never consulted prior to the implementation of the institutional sakai LMS I was just told that there is that system for use in the teaching and learning practice*", [L002]. Similar sentiments were shared by many participants who claimed that they were not consulted prior to the implementation of the ICTs, as detailed in Appendix R.

Only a single lecturer, [L001] acknowledged having been consulted prior to the implementation of the Sakai LMS, although that lecturer further noted that only 20% of their input was considered. These findings reflect the results reported in other empirical studies, showing that a lack of user involvement in decision-making usually results in ICT implementation failures (Soomro et al., 2020; Gwamba et al., 2017). A lack of user involvement in decision-making was also indicative of poor planning, as demonstrated in the next section.

Planning and ICT allocation

Planning was a recurrent topic in discussions about leadership, and empirical analysis revealed that as a result of poor planning, ICT resources were neither adequate nor fairly distributed. Participants revealed that "*laptops are only given to the top personnel in the hierarchy, we as lecturers are not given*" [L009]; "*there are few departments with ethernet cables otherwise the rest of students depend on WI-FI which is usually down* [FG013]; "*we have few computers that are shared among all the departments in the faculty*" [T004]; *There are shortages of venues and where we are right now is not a lecture room as you can see people walking, screaming, talking etc*" [FG005]; "*buildings are collapsing before they are completed*" [FG002]. These comments are indicative of inadequate planning for ICT adoption and use.

These findings echoed those of other cases reported in the literature, which shows that the successful adoption of ICTs depends on good planning (Chitanana, 2014; Koponen, Tedre, & Vesisenaho, 2011). It was also apparent from the participants' narratives that poor planning had an accompanying negative impact on funding as shown below.

Funding for ICT Projects

The study's empirical data indicated that there was a lack of funding for ICTs at the HEI case. This was communicated in the following comments: "*there are always costs incurred during* *these ICT workshops but now that the university is cutting on costs its now a challenge*" [T006]; "*the university is not sufficiently funded to purchase upcoming technologies"* [C012]*; "we are in an environment that is resource constrained and expenditure on ICT software is not welcome"* [L001]; *"they say there is no money to buy us computers"* [L009]; "*we were told that it is the responsibility of students to pay software license fees and to acquire their own software*" [L010]; "*the department doesn't have funds to buy up-to-date software*" [FG006]. [L009], concluded that "*some students can't even afford to pay full fees so we can't add that burden on them*".

These empirical observations were consistent with existing literature, which shows that funding is an integral aspect that precedes the adoption of ICTs (Govender & Chitanana, 2016; Koponen et al., 2011). For instance, Andersson and Grönlund (2009) argue that ICT developments depend on funding for them to be successful. However, HEIs, particularly in developing countries, lack the financial resources that are needed to acquire, repair or replace ICT resources (Nyahodza & Higgs, 2017; Rana et al., 2020; Avgerou et al., 2016). It could therefore be concluded that issues of funding for ICTs were linked to the context within which, financial and other resources for the promotion and adoption of ICTs are supplied.

7.2.3 Context

Literature shows that an organisation's context determines the activities that occur in that organisation (Ranson et al., 1980). Andersson and Grönlund (2009, p. 6) define the context of e-learning as "the context of the delivering organisation (typically a university setting) as well as the context of the society in which the e-learning takes place, including culture, traditions, rules and regulations". It can be deduced from this definition that both the organisation and its environment form the context, which exerts pressure on the organisation's ability to deliver e-learning (Gwamba et al., 2017; Sebbowa & Muyinda, 2018; Rana et al., 2020)

Context was a recurrent theme in discussions surrounding the adoption of ICTs in the HEI case. The common feeling was that the HEI context discouraged ICT use instead of motivating ICT adoption, as is evident from the following comments: "*The environment is not safe because several students have lost their personal laptops and other belongings to thugs*" [FG004]; "*Going home and coming with a laptop during late hours is tricky*" [FG010 and "*we have had cases where people have lost their gadgets here on campus like during exams, we leave our laptops outside the examination venue and you just find your laptop gone*" [FG003]. Several participants identified culture, policies and the HEI's eco-system as contextual inhibitors of ICT adoption, each of which was discussed in the following sections.

Culture

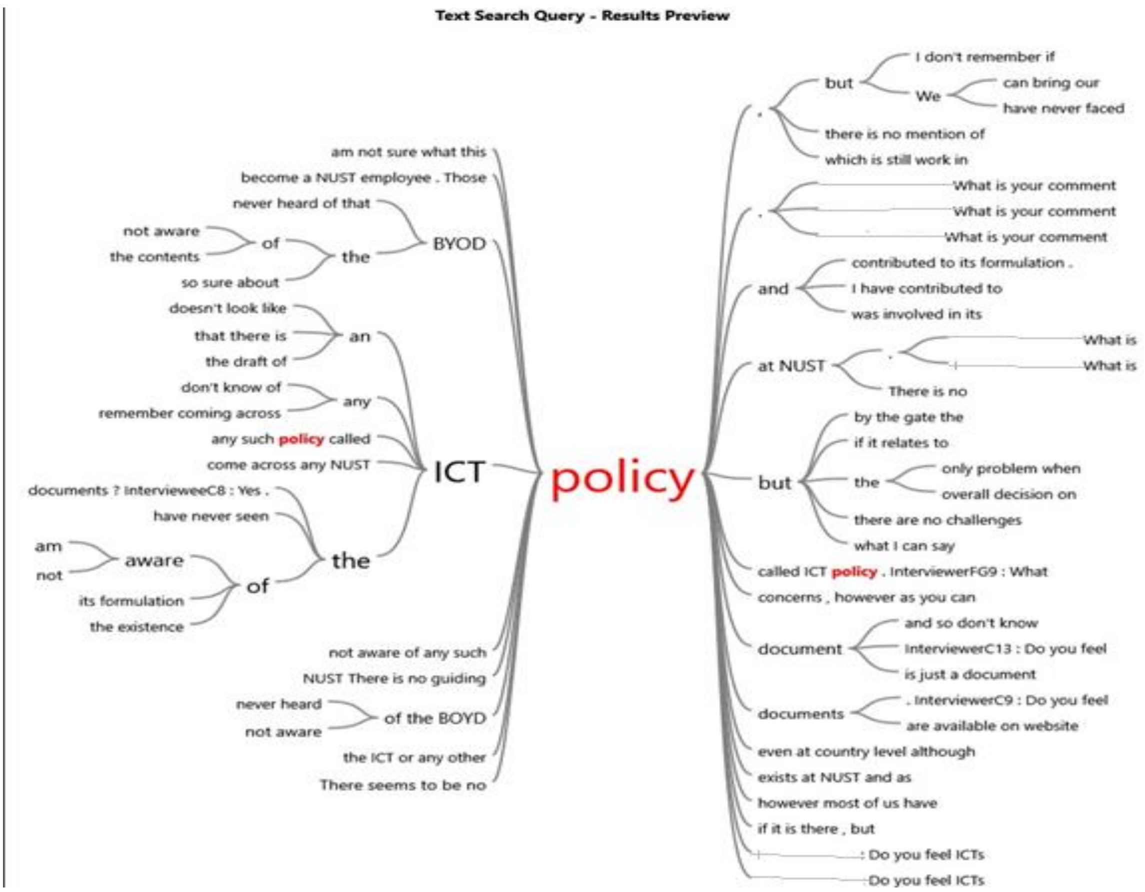
Culture refers to the set of beliefs, norms and standards that are found within a social system (Scott, 2004). In the HEI case, discourses on culture included the following comments: "*The classroom infrastructure supports the traditional method you get into class and dictate notes and then walk out"* [L005]; "*The culture is the old school*" [L012]; "*the culture here is more inclined towards the traditional teaching and learning methods*" [L007]; "*the belief here is that ICTs are mostly viewed as communication and entertainment and not education tools*" [C010]. A group of students concluded that "*Taking pictures or recording a lecturer teaching is taboo that is not allowed*" [FG004]. Support for the prevailing education culture can be found in the copies of timetables included in Appendix S and Appendix T. The researcher also observed that it was mandatory for attendance and attendance registers to be completed as stipulated in ordinance 30 of the NUST year book (available at http://www.nust.ac.zw).

These empirical observations were consistent with literature showing that many HEIs still prioritised physical learning spaces and traditional methods of education (Kundi, Nawaz, & Khan, 2010; Tadesse, Gillies, & Campbell, 2018). Therefore, such education cultures that are resistant to technological changes, hinder the adoption of ICTs. The education culture of an institution is usually influenced by its existing policies, which regulate how organisational activities and processes must occur. ICT implementations usually fail if misaligned with the culture (Gwamba et al., 2017). The next section illustrates how the empirical observations of participants provided evidence of the influence of policies on the adoption of ICTs.

Policies

Policies are crucial elements for legitimatising organisational practices (Teo et al., 2003; Zucker, 1987). Lyytinen and Ngwenyama (1992) refer to policies as codified rules for regulating organisational practices. In the context of the HEI, an ICT policy should provide guidelines on how to integrate ICTs in education. However, the empirical data showed that at the HEI case, important policies were nor explicit, as demonstrated in the word tree in Figure 7.3. A common view among the research participants was that ICT and BYOD policies are not available or do not exist as evidenced by their comments.

Figure 7.3 *Word Search for Policy (NVIVO generated from data)*



The sample comments read: *"I am not aware of the ICT policy at NUST", "I have never seen the ICT policy document", "I have never heard of the BYOD policy",* and *"I don't know of any ICT policy there is nothing like that".* These comments pointed to a broader picture which supports the view that policies were not explicit; although Appendix U contains the ICT policy, which was not accepted until after the data collection period (2016-2018).. Environmental condition was a further contextual issue constraining the adoption of ICTs at the HEI case.

Environmental conditions

The narrative accounts revealed that "*the major challenge that we have when we are using the projector in this classroom is that the room has too much light, so we hardly see what will be projected*" [FG011]; "*use of projectors depends with the classroom that you are using if you go to other classrooms it's pointless to use the projector because the space is small, and the lighting is very bad*" [FG007]. Figure 7.4 illustrates lecture rooms with lighting problems.

Figure 7.4 *Computer Labs with Too Much Light*

Literature suggests that the environmental conditions of developing countries may also be unfavourable for ICTs due to humidity, dust, dirt and heat (Tedre et al., 2010; Hosman & Armey, 2017; Omotayo & Tiamiyu, 2017). It also emerged from this study's empirical data that additional ICT adoption challenges existed as a result of perceptions about the ICTs implemented at the HEI case.

7.2.4 Perceptions

Literature recognises the crucial role of perceptions in enabling or constraining the use of ICTs in organisational processes (Ranson et al., 1980; Schneckenberg, 2009). Several studies have confirmed the behavioural theorists' observations of a link between ICT usage and behaviours involving attitude and control (Davis, 1985; Rogers, 1995; Ajzen, 1985; Bandura, 1977).

An empirical analysis of this study's data revealed that the research participants' perceptions influenced their decisions relating to the adoption of ICTs within their education practice. Some perceived ICTs to be good tools for education, evident in the following sample quotes: "*Regarding user friendliness, probably I am biased, but I think Google-Classroom is better*" [FG011]; "*Google-Classroom has an appealing layout and is more professional*" [FG008]; "*we can access Google-Classroom from anywhere and the interface is nice*" [FG001]; "*I have seen everything that Google-Classroom is capable of, it allows me to upload videos of my lectures*" L005]; *Google-Classroom is simpler to use*" [L008]; "*ICTs are the best because this 21st century era, demands a paperless environment*" [FG013]; *online education is efficient and anyone can access material anywhere*" [FG009].

Another group of participants had negative perceptions of ICTs as they found them difficult to use or less valuable. These concerns were mentioned in the following comments: "*By using ICTs we lose control of the contents of our mobile devices"* [FG001]; "*Online lectures are difficult to implement and monitor*" [L002]; "*I hardly use ICTs like Sakai because it gives me extra work*" [L011]; "*Sakai e-learning platform is not friendly, and the students have problems accessing it outside campus*" [L006]; "*MOODLE was difficult to use and these systems are not related to each other*" [L012].

These sample comments were consistent with findings from prior empirical studies conducted on the same HEI case by the author of this thesis which recognised the role of perceptions in the decision to adopt ICTs (Dube & Scott, 2016; Dube & Scott, 2017a). Positive perceptions increased participants' willingness to adopt ICTs while negative perceptions hindered ICT adoption. Although there were many aspects to user perception, distinct attitudes towards ICTs and the control of those ICTs emerged from the discussions held with research participants. The discussion of perceptions therefore focussed in more detail on issues of attitude and control.

Attitude

Attitude is defined as an individual's affective behaviour towards a human or material resource (Davis, 1985). Attitude reflects the psychological make-up of an individual and may be either negative or positive. The attitudes of participants were revealed in a variety of discourses involving ICT attributes, as shown in Table 7.5.

Table 7.5 shows that participants perceived the institutional ICTs to be difficult to use, add little educational value, and to lack integration. These perceptions correspond to the Diffusion of Innovation (DOI) constructs of complexity, relative advantage and compatibility (Rogers, 1995). The empirical findings from the HEI case were therefore consistent with existing literature, which associates ICT adoption with attitudes towards those ICTs (Davis et al., 1989; Venkatesh, Morris, Davis, & Davis, 2003; Dube, 2017b).

Table 7.5 *Attitudinal Concerns about the Attributes of ICT Artefacts*

Attribute	Source	Sample data extract
Difficulty of use	[FG002]	*When writing a test, the Sakai LMS keeps crashing and freezing.*
	[FG004]	*Sakai LMS is all problems, tedious log in and is not user-friendly.*
	[L001]	*Sakai LMS is only accessible within the confines of NUST.*
	[FG012]	*Sakai LMS is not interactive and lacks dynamics of modern LMSs.*
	[FG001]	*The Sakai LMS platform is not only ugly, but it is too rigid.*
No value addition	[FG001]	*The interaction between learners and the online instructor is missing.*
	[L001]	*I use attachments & announcements beyond that there is no justice because Sakai LMS tools only support a summative assessment.*
	[L010]	*The eLearning platform is not useful for my courses.*
	[T006]	*Sakai LMS lacks the intelligence to mark the open-ended questions.*
	[FG013]	*e-resources themselves are outdated.*
Disintegration	[FG001]	*NUST ICT systems are not compatible with each other.*
	[T002]	*This articulate software is not linked to the Navision ERP system used by lecturers to upload students' marks.*
	[T006]	*With Navision there is currently no link with Sakai LMS.*

In an earlier study, Ranson et al. (1980) argue that organisations intending to implement ICTs must be conscious of perceptions about those ICTs. Davis (1989) acknowledges that perceptions about an ICT's usefulness and ease of use are important determinants of the user's attitude towards those ICTs; while Macredie and Mijinyawa (2011) observe that users generally develop a negative attitude towards ICTs that are perceived to have no functional benefits in terms of their work performance. Mapuva (2009) concludes that the successful adoption of ICTs depends on, but is not limited to, the attitudes of users towards ICTs. While this section presented evidence from empirical data and literature regarding attitude, the next section focuses on control.

Behavioural Control

Control is associated with having the ability or resources needed for completing a task (Davis, 1985). Table 7.6 lists control issues that emerged from the data involving technophobia, fear, resistance, and self-efficacy. Technophobia, refers to anxiety caused by "an inability to cope with the demands of organisational computer usage" (Tarafdar, Tu, & Ragu-Nathan, 2010, p. 303). Technophobia was apparent in the following sample quotes: "*Lecturers don't trust technology they say technology fails them*" [L011]; "*lecturers are just suspicious of the ICTs that they will take their jobs*" [T004]; "e*verybody has a comfort zone and ICTs are not one such*" [C002]. "*it seems the lecturers are technophobic*" [T002]; [C001] mentioned having experienced anxiety associated with the implementation of an ERP. Literature confirms that technophobia hinders the adoption of ICTs in HEIs (Bellini et al., 2016; Bhuasiri et al., 2012).

Table 7.6 *Sources of Loss of Control from Empirical Data*

Attribute	Source	Sample data extract
Technophobia	[C001]	*A lot of people were frustrated, and they ended up not using it.*
	[FG012]	*I prefer f2f because I am not technologically advanced.*
Fear	[L003]	*it is not easy to adapt to the new technologies because of fear.*
	[L011]	*just call it inertia to technology, very few people are using sakai.*
	[L010]	*The course requires that students don't use phones in a lecture.*
	[L004]	*I find the use of ICTs in class becoming a disturbance in my classes.*
Resistance	[C002]	*I was having problems with my machine, it kept freezing but I could not switch to windows 10 and kept my windows 7.*
	[L012]	*I am happy using the traditional mode because it is good.*
	[L008]	*People were reluctant to leave their old ways of doing things.*
Low self-efficacy	[L012]	*I am comfortable with what I have been doing.*
	[L007]	*I have basic ICT skills, but I am not comfortable using computers.*

Discussions on the topic of behavioural control also included fear, as is evident in the following sample comments: "*Supervisors are afraid of using the available ICT resources"* [FG006]; "*I think there is fear of ICTs"* [FG001]; "*I can't leave students alone online and teach from my office because I believe ICTs are a distraction*" [L002]; "*There are reasons people may not want to adopt new technology and these include: fear*" [C010]. Existing studies have also identified the perception that fear obstructs the adoption of ICTs (Cox, Preston, & Cox, 1999; Macredie & Mijinyawa, 2011).

The empirical data also referred to resistance to ICTs, which was revealed in comments such as: "*some lecturers are reluctant to use new technology*" [C009]; "*some members of staff are reluctant to partake in ICTs*" [C012]; "*people are reluctant to changes in technologies*" [C013]; "*there was some resistance to adopt the Sakai e-learning platform"* [T004]. Existing literature confirms that resistance to ICTs obstructs their adoption (Macredie & Mijinyawa, 2011; Hee-Woong & Atreyi (2009).

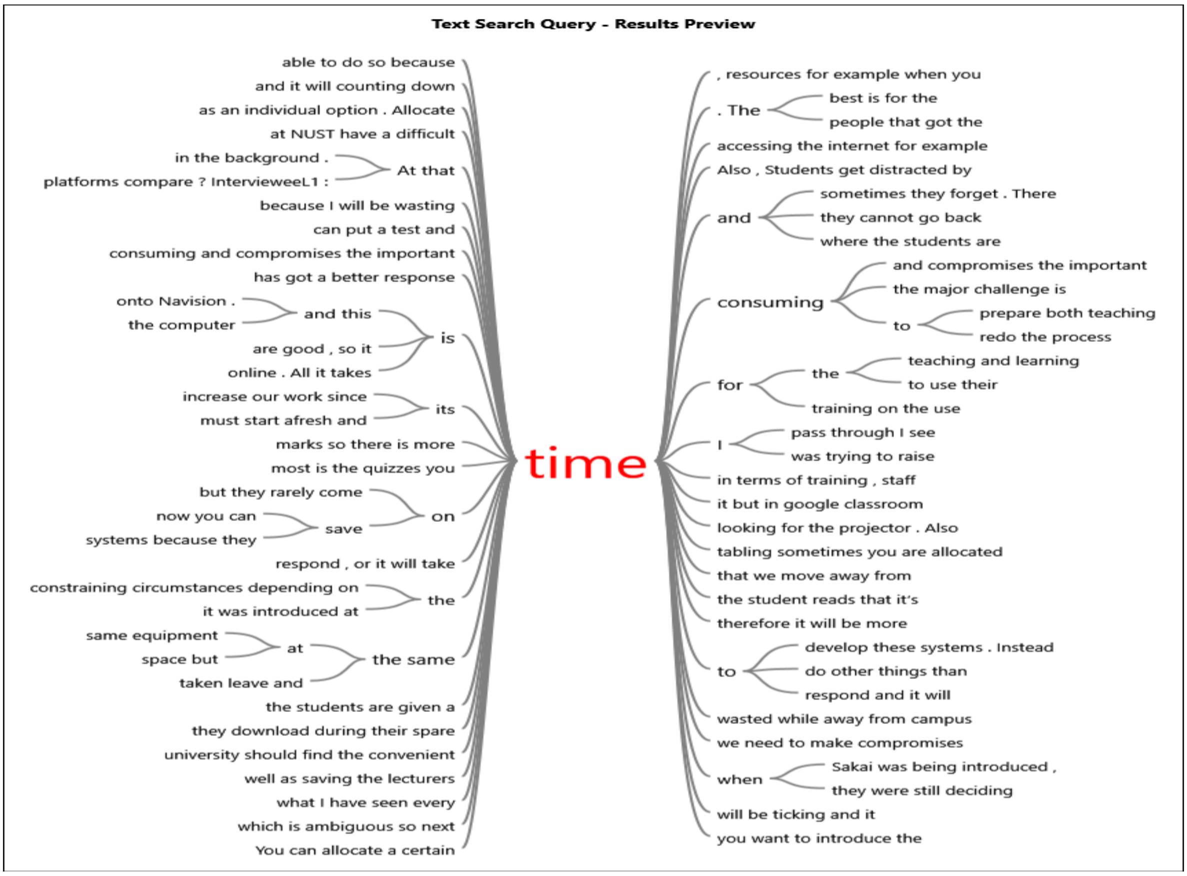
Self-efficacy was observed in comments that read: "*lecturers are aware of the available ICTs, but they don't know how to use them*" [T002]; "*supervisors are not accustomed with these resources"* [FG006]; "*we are dealing with naive users who do not know how to use these ICTs*" [FG002]; "*there is a lack of understanding on how to teach with ICTs*" [FG001]. These findings complemented the results reported in the literature, that low self-efficacy hinders the successful adoption of ICTs (Macredie & Mijinyawa, 2011; Gameel & Gwinn, 2019; Barclay et al., 2018).

The issue of time management was also referred to during discussions on behavioural control. Lecturers in particular indicated that they had limited time to learn how to use ICTs and how to integrate them in their teaching practice. When read from left to right, the word tree in Figure 7.5 indicates that there is "*limited time to prepare lectures to be delivered online*", "*limited time to learn how to integrate ICTs in teaching"*, "limited time to *learn how to engage with the* *institutional learning systems"*, "*we don't have time to be looking for scarce projectors"* and "*it is time consuming to double capture the same marks of students"*.

These empirical findings confirmed the results reported in a study by Keengwe, Kidd, and Kyei-Blankson (2009, p. 26) who note that,

> *Nearly all the participants indicated that technology adoption was a time-consuming process. With pressure to teach well, conduct research, service commitments, accreditation assessments, professional development, and meetings, the faculty reported that they lacked time for additional responsibilities.*

Figure 7.5 *Word Tree for the Word "Time" (own construct informed by data)*



This section presented evidence from the empirical data that supports the four main themes regarding constraints affecting the adoption of an ICTs in the HEI within Zimbabwe. While it may have appeared that most of the findings were consistent with literature and might have left the reader wondering what could be new, the following sections demonstrated how these literature-supported empirical findings facilitated the identification of underlying structures leading to the 2nd order digital divide in the HEI case. This discussion of emergent themes also provided a starting point for identifying the interlocking dynamics that link ICT adoption to structures leading to the 2nd order digital divide problem. The process of identifying structures required a revisit to the concepts of Structuration Theory as it guided the data collection, analysis, and the interpretation of the empirical findings.

7.3 Structures Leading to the 2nd Order Digital Divide

Having identified the main themes relating to causes of ICT adoption, what remained was to follow up on the aim of this study with regard to the identification of structures that lead to the 2nd order digital divide in the HEI case. For this purpose, I followed a deductive reasoning process to search for evidence that could be mapped to corresponding signification, domination and legitimation structures as defined in Structuration Theory. With the help of the existing literature, the researcher was able to map this study's empirical data to Structuration Theory's structures of signification, domination, and legitimation.

The first step was to identify structures of signification, which relate to sense-making or the assignment of meanings to human actions (Giddens, 1984). Through the s**ignification structures** the researcher could discern whether the research participants considered ICTs to be important tools for education. The results from the empirical data revealed that the participants assigned more negative than positive meanings to ICTs. This was evident in the following comments: "*I use Sakai mainly to distribute material and not as something that could be used to explain a concept*" [L001]; "*Sakai is not interactive. it does not check if I am performing well, the interaction between a learner and the instructing system is missing"* [FG002]; "*unless we are given space to fully bring out our creativity on Sakai then all of us will remain confined to quizzes and giving out simple tests*" [L005]; "*if you were to give an* *online test you are likely to give a multiple choice then a guessing student can make it without knowing anything*" [L001]. These narratives revealed that the adoption of ICTs as tools for education was constrained by the produced structures of signification, resulting in the 2nd order digital divide. Sense-making in relation to the adoption of ICTs was also associated with the produced structures of domination as shown below.

Domination structures relate to the use of power based on the facility to allocate and control the use of resources (Giddens, 1984). These structures were evident in discourses like "*use of ICTs is not a standard its by choice*" [L003]; "*Resource allocation is based on need*" [C007]; "*resource distribution depends on the need for use*" [C012]; "*If management does not prioritise ICTs, then ICTs will never be given the prominence they deserve*" [C010]; "*the allocation of ICTs is based on need, not on appropriation*" [C011]; *currently the computers are not distributed equally and are not used appropriately because there is no limit on what to access*" [FG003]. It could be discerned from these comments that structures of domination have been created, which in turn constrain ICT adoption, leading to the 2nd order digital divide in the HEI case. The power relations that influenced the allocation of ICT resources also influenced the production of structures of legitimation, which were used for specifying the legal moral order.

Legitimation structures concern the enforcement of moral order (Lyytinen & Ngwenyama, 1992). These structures emerged in discourses about what is regarded as acceptable within the existing educational culture, as observed in the following comments: "*The culture is the old school side and if people are not comfortable with ICTs they will stick to the old school side*" [L012]; "*we are still back then when lecturers are dictating notes*" [FG006]; "*we are very traditional we always encourage our students to take down the notes*" [L011]; "*The classroom structure supports f2f delivery* [L005]; "*I believe a lecturer must be present and if I were to put a ratio, I would say 60% f2f and 40% ICTs"* [L001]. These comments point to the produced legitimation structures that constrain the adoption of ICTs so as to result in the 2nd order digital divide in this HEI case.

Although the researcher identified the existing signification, domination, and legitimation structures within the HEI case, much of the empirical evidence that had been gathered could not be mapped to these Structuration Theory structures. Additional themes that unfolded from the inductive reasoning process were linked to belief, institutional and governance structures. Compelling evidence of the existence of these structures is provided in the next sections.

7.3.1 Belief Structures

The empirical data revealed that for many participants, belief structures were fuelled by self-motivation and the desire to be perceived as modern or "cool", as is evident in the following comments "*using ICTs is not a challenge because my first encounter with the computer I was in grade four*" [L008]; "*I am on the creative side and strive to do things differently. so, I end up using my personal resources to excel regardless of the environment and reach for the sky*" [L005]; "*I have young lecturers who are very technologically literate all of them. I have some who go on study leave part time they give lectures to their students while they are there"* [C006].

There were also participants who believed that they were either not able or not willing to adopt ICTs. For [FG012] claimed that "*I am not technologically advanced"*, while. [L004] stated that "*I am old schooled, and I find the use of ICTs in class becoming a disturbance*" and [L012] confirmed that "*I am old schooled, and I am happy using the traditional mode because it is good, and I have been doing it for the past 20 years*". [L010] believed that "*e-learning platforms are not useful for my courses*". Others said "*I believe in hearing concepts being explained by the lecturer*" [FG009] and "*to understand better I need someone to first explain*" [FG012]. [L001] also claimed that "*I believe that for explanation it is important for a lecturer to be present in class*".

The preceding comments show that while positive beliefs enable ICT adoption, negative belief structures constrain the adoption of ICTs in the HEI case and thus contribute to the 2nd order digital divide. These empirical findings are consistent with existing studies, which indicate that the belief structures have an influence on the adoption of ICTs (Ajzen, 1985; Taylor & Todd, 1995; Davis, 1985). For example, Macredie and Mijinyawa (2011) found that belief structures facilitated the adoption of Open Source Software (OSS) by small to medium enterprises. Ngwenyama and Klein (2018) also report on belief structures that led to the failure of an Information System infrastructure project in Germany.

This section provided evidence that belief structures constrain the adoption of ICTs to result in the 2nd order digital divide in the HEI case. It also emerged from the empirical data that these belief structures were fuelled by the conditions of the institution within which the lecturers and students are situated, as is demonstrated in the next section.

7.3.2 Institutional Structures

An institution consists of both internal and external structures (Scott, 1987). It was apparent from the empirical evidence that institutional structures which are either internal or external to the HEI contribute to the 2nd order digital divide. These institutional structures were mentioned in discourses involving the HEI leadership and their allocation of resources. For example, a group of students claimed that, "*no one prioritizes the ICTs, and it is such thinking that is causing another drawback, or anything related to technology*" [FG002]. Lecturer [L001] also experienced that "*the process of acquiring software is very difficult so I had to drop mid-way.*". [C001] and [C011] argued that the adoption of ICTs depends on the institutional leadership's commitment to the allocation of adequate resources. A chairman, [C010] observed that "*budget approvals for ICT acquisition hinges on management appreciation of ICTS*", while [T005] claimed that the leadership of the HEI case was cutting costs including the budget for e-learning activities.

The narrative comments also revealed that inherent institutional structures were contributing to a lack of adequate resources such as electricity, desktop computers, power sockets and other vital infrastructure for connecting to the Internet as is evident from the comment that. "*there are Internet connectivity challenges due to power cuts*" [C011]. Students also complained that the few computers in a faculty lab are always occupied [FG010]. Several participants including [L009], [FG004] and [FG010] were concerned that the computer labs were being used to compensate for a shortage of lecture rooms. This situation has resulted in the unacceptable practice of lectures being held in open and noisy spaces that are not conducive to learning [FG005].

Although it might appear from the above comments that resources are not available, [C008] observed that the underlying problem is not only related to resource availability, but also to poor distribution of resources. In support of this argument, [C007] emphasised that there is *"the need for partnerships with private institutions for revenue generation to improve ICT infrastructure*". From a different perspective, a group of students [FG001] agreed that inadequate training is provided on how to use the e-learning systems implemented at the HEI. [FG012] confirmed that "*we did not receive any training and were not aware of the online learning platforms till recently when we just saw other students from other departments using them*".

These empirical observations were consistent with literature, which associates ICT adoption with institutional structures (Ranson et al., 1980; Schneckenberg, 2009; Dube & Scott, 2018; Sibanda, 2020). Studies also acknowledge the role of institutional structures in the acquisition and distribution of ICT resources (Ranson et al., 1980). This implies that there are institutional structures that enable or constrain the adoption of ICTs (Giddens, 1984; Ngwenyama & Klein, 2018; Ngwenyama & Hardt, n.d.).

While this section has demonstrated how the institutional structures contribute to the 2nd order digital divide, the empirical data also revealed a bigger problem involving the governance structures discussed in the next section.

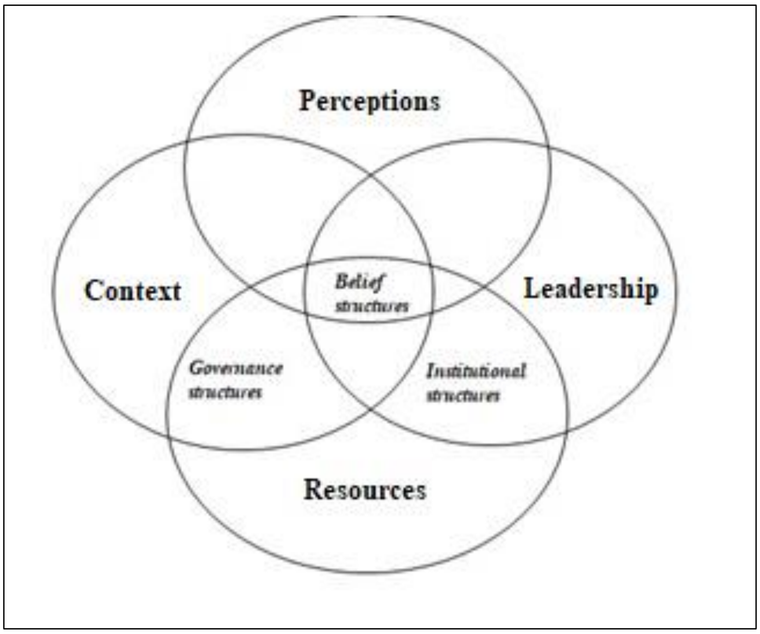
7.3.3 Governance Structures

The identified governance structures related primarily to policies. The formulation of national-level education and ICT policies is governed by the state through the respective ministries. However, [L006] revealed ignorance of the ICT policy by stating that "*I don't know of any ICT policy even at country level*". The participants' narrative accounts also demonstrated that they believed that it was the government's responsibility to provide funding for universities [C012], although [FG002] argued that "*the government was neither investing in ICTs nor giving funds to HEIs in certain regions*". These discourses confirmed that governance structures contribute to the 2nd order digital divide in the HEI of Zimbabwe.

These empirical findings are in accordance with literature, which implicates the role of governance structures in institutional practices (Zucker, 1987; Teo, Wei, & Benbasat, 2003; Scott, 2004; Eisenhardt, 1988). Literature also associates the adoption of ICTs with governance structures (Ngwenyama & Hardt, n.d; Ngwenyama & Klein, 2018). It was apparent from these studies that governance structures can either enable or constrain the organisational activities.

Although these empirical findings were supported by literature, they enhanced an understanding of the structures behind the 2nd order digital divide, which are narrowly discussed in literature. Figure 7.6 therefore illustrated a broader picture by providing a high-level representation of the additional structures manifest in the emergent themes.

Figure 7.6 *Emergent Themes and Manifest Structures*



With the underlying structures of the 2nd order digital divide having been identified, the question that remained to be answered related to the interlocking dynamics of ICT adoption to which these structures were implicated. In this regard participants repeatedly referred to the four elements of leadership, adoption behaviours, resources, and empowerment, which are discussed in detail in the next chapter.

7.4 Conclusion

This chapter reported findings from the analysis of the empirical data regarding the emergent themes of Resources, Leadership, Context and Perceptions. The chapter began by providing resounding evidence from empirical data to support the existence of these four emergent themes as reflected in the word frequency and code counts, respectively. The chapter proceeded to report findings based on a deductive reasoning which pointed to Structuration Theory's signification, domination, and legitimation structures. This was followed by a discussion of further results that were obtained through inductive reasoning, and which identified relevant belief, institutional and governance structures. The chapter concluded by emphasising that together the theory-driven, and data-driven structures provided a broad high-level picture of the problematic structures and provided a holistic explanation of the structures behind the 2nd order digital divide, which is a significant problem in the HEI case. The researcher then referred to four interlocking dynamics of ICT adoption, leadership, adoption behaviours, resources, and empowerment, which are elaborated on in detail in the next chapter.

Chapter 8: Theoretical Elaboration of Findings

8.1 Introduction

Chapter 7 provided empirical evidence that supported the emergent themes of Resources, Leadership, Context and Perceptions. It also reported on findings related to the theory-driven structures of signification, domination, and legitimation as well as findings related to the data-driven structures of belief, institutional and governance. Chapter 7 then concluded by confirming that together these structures lead to the 2nd order digital divide in the HEI case of Zimbabwe and referred to four interlocking dynamics of ICT adoption: leadership, adoption behaviours, resources and empowerment which are discussed in more detail in this chapter.

This chapter reports on the results of a theoretical elaboration of the findings, which was based on a combination of contrasting and structuring techniques as defined by Fisher and Aguinis (2017). The chapter begins by evaluating the limitations of mapping the empirical findings to Structuration Theory, which was the guiding theory used for interpreting the research findings. This is followed by an explanation of Leadership, Adoption Behaviours, Resources and Empowerment, which are the resultant interlocking dynamics of ICT adoption in the HEI case. The chapter concludes by discussing the implications of the research findings in relation to the two key research questions that were identified in Chapter 1.

8.2 Mapping Empirical Findings to Structuration Theory

The initial findings resulting from a deductive reasoning process attributed the 2nd order digital divide partly to Structuration Theory's structures of signification, domination, and legitimation. This partial explanation exposed Structuration Theory's inadequacy with regard to providing a full explanation of the structures leading to the significant 2nd order digital divide that exists in the HEI in Zimbabwe. Literature attributes Structuration Theory's inadequacies to several causes, chief among which are the following three reasons.

First, literature suggests that Structuration Theory was developed with a developed country's community in mind (Follman, 2015). This meant that the circumstances of HEI communities within a developing country are not specifically accommodated by Structuration Theory and are neither represented nor addressed. Second, Structuration Theory is a general, high level and abstract theory that does not necessarily meet the needs of any one specific empirical situation (Pozzebon, 2000; Archer, 2010). This implied that the structures inherent in a specific HEI within the unique context of Zimbabwe could not be fully captured. Third, Structuration Theory does not make an explicit reference to technology (Jones & Karsten, 2008). This presented a challenge in identifying the interlocking dynamics of ICT adoption that are necessarily implicated in the structures leading to the 2nd order digital divide in the HEI case.

Providing a complete explanation of the structures of this phenomenon therefore required an adaptation of Structuration Theory to encompass the adoption of ICTs in the empirical situation of the HEI whose contextual circumstances are unique to a developing country that is inhabited primarily by black communities. This decision was informed by existing literature, which emphasises that an employed theory must be appropriate to an empirical situation and its context (Fisher & Aguinis, 2017; Mbarika et al., 2005). While Structuration Theory was a vital starting point, it suited neither the empirical situation nor the context of research (Rose & Scheepers, 2001; Bryant, 1999). Fortunately, the shortcomings of Structuration Theory could be addressed through a six-step process which involved the identification of the interlocking dynamics of ICT adoption discussed in the next section.

8.3 The Interlocking Dynamics of ICT Adoption in the HEI of Zimbabwe

This section reports the results of a six-step process that was used to identify the interlocking dynamics of ICT adoption. In the first step, the researcher used an appropriate feature in NVIVO 12 to create a word frequency query that searched for the most referenced words in the empirical data. The researcher then queried the empirical data for the ten most frequent words of at least six letters (generalised on the basis of word similarity) as shown in Appendix V. Table 8.1 and Appendix W show the query results.

The first cycle of the word search identified the ten high-frequency words depicted in Appendix W. The final cycle involved the elimination of less significant words, words with a low word-count, and words with meanings similar to the high-count words listed in Table 8.1.

Table 8.1 *A List of Frequently Referenced Words (informed by data)*

Word	Length	Count	Weighted percentage (%)	Similar words
leadership	6	701	0.81	acquiring, acting, administration, advise, adoption, allocation, appropriation, assessment, assist, assistance, assume, attention, choice, collaboration, communicating, compromise, contribution, creation, decision, delivery, development, favour, impact, influence, leadership, maintenance, management, motivating, motivation, payment, politics, recommends, representative, responsibility, sharing, standardization, sustenance, training.
behaviour	10	690	0.83	accept, acknowledge, acting, active, activities, assist, assistance, attention, attrition, behaviour, booking, capture, change, comfort, complement, contribution, creation, development, digging, disintegration, distraction, freeze, freezing, hunting, interest, inventory, limitation, manual, practice, resistance, resort, sponsorship, struggle, sustenance, timing, training, utilisation, voicing, workload, advantage, alternative, choice, favourable, option, orient, prefer, promoted.
resources	9	563	1.43	adapter, assets, battery, device, devices, display, engine, facility, filter, generator, inventory, keyboard, locker, machines, monitor, printer, radius, recording, resource, resourced, resources, router, security, surface, switch, software.
empowerment	8	469	0.85	accomplish, acquire, checked, conditioning, conditions, developed, development, direct, directed, literacy, master, manual, practice, prepared, preparing, precise, proficiency

Table 8.1 shows that *Leadership, behaviour, resources, and empowerment* were the words with the highest counts, of 701, 690, 563 and 469, respectively. *Support, practice,* and *knowledge* were incorporated in leadership, behaviour, and empowerment respectively; however, *moving, events* and *change* did not appear to have a significant meaning, leading to their exclusion. Leadership was described by words involving management activities like support, motivation, planning and reputation. Behaviour reflected perceptions about ICT adoption like control, attitude, imitation (herd) and resistance; it is with this mindset that from this point onwards, behaviour is prefixed with the word "adoption" to read Adoption Behaviours. Resources concerned the acquisition, allocation, utilisation, and prioritisation of ICTs. Empowerment related to having the autonomy, authority, competence, and experience to use ICTs.

The second step towards identifying the interlocking dynamics of ICT adoption involved establishing relationships among the concepts that together described the four popular words identified in the first stage of this process. The researcher, therefore used the text search facility on NVIVO 12 to search for the number of times that two concepts appeared together. For example, "Acquisition" AND "Allocation", "Allocation" AND "Utilisation", "Utilisation" AND "Prioritisation" and "Prioritisation" AND "Acquisition", as depicted in Appendix X. A summary of this word search is provided in Table 8.2, which quantitatively shows the paired occurrences of concepts.

It is apparent from Table 8.2 that despite the large overall number of intra-relationships, there are only a few important relationships among the identified concepts. For example, the high frequency of co-occurrences involving acquisition and allocation, allocation and utilisation, utilisation and prioritisation, and prioritisation and acquisition implies that these concepts appear together and therefore share notable relationships with each other. The same process was followed to analyse the co-relationships between concepts that were relevant to

Leadership, Adoption Behaviour and Empowerment; the output is attached in this thesis as Appendix Y.

Table 8.2 *Query Results from a Text Search*

	Acquisition	Allocation	Utilisation	Prioritisation
Acquisition	20	9	4	6
Allocation	9	2	17	2
Utilisation	4	17	93	43
Prioritisation	6	2	43	27

The third step involved establishing interconnections among leadership, adoption behaviours, resources and empowerment, the frequent words that the researcher identified in the first step. To do this, the researcher used the Matrix coding facility provided in NVIVO 12 to create a matrix query that included the four frequent words, which was then associated with an "AND" conjunction. The results from the matrix query are depicted in Table 8.3 where the presence of an interconnection is illustrated by "Yes" while "No" indicates a non-existent relationship, as in the case of empowerment and resources.

Table 8.3 *The Key Concepts from a Matrix Query in NVIVO 12*

	Leadership	Adoption behaviours	Resources	Empowerment
Leadership	Yes	Yes	Yes	Yes
Adoption behaviours	Yes	Yes	Yes	Yes
Resources	Yes	Yes	Yes	No
Empowerment	Yes	Yes	No	Yes

Contrary to earlier literature, which associated empowerment with use of resources (Andersson & Grönlund, 2009; Sarker & Lee, 2003), the results in Table 8.3 surprisingly revealed no relationship between empowerment and resources. This exceptional result was attributed to a coding error since in the empirical data, cases like [T005] and [C002] had observed that poor empowerment was due to limited financial resources.

Table 8.4 shows the frequency of inter-relationships between the key concepts, which is in this case measured by the number of times the concerned concepts appear together. For example, the empirical data for this study showed that the concepts “Leadership “and “Adoption behaviours” frequently appeared together with a count of 12 times while “Adoption behaviours” and “Empowerment” had a less valid relationship with a single count of co-appearance. “Resources “and “Empowerment” shows no relationship, which is possibly a coding error, since [T006] claims that reduced budget (resource) negatively affects training (empowerment) of both the lecturers and students. This proves that there was a missed relationship between “Resources” and “Empowerment”.

Table 8.4 *An Extract of Four Variables from Matrix Coding in NVIVO 12*

	Leadership	**Adoption behaviours**	**Resources**	**Empowerment**
Leadership	145	1	5	2
Adoption behaviours	12	16	3	1
Resources	5	3	93	0
Empowerment	2	1	0	28

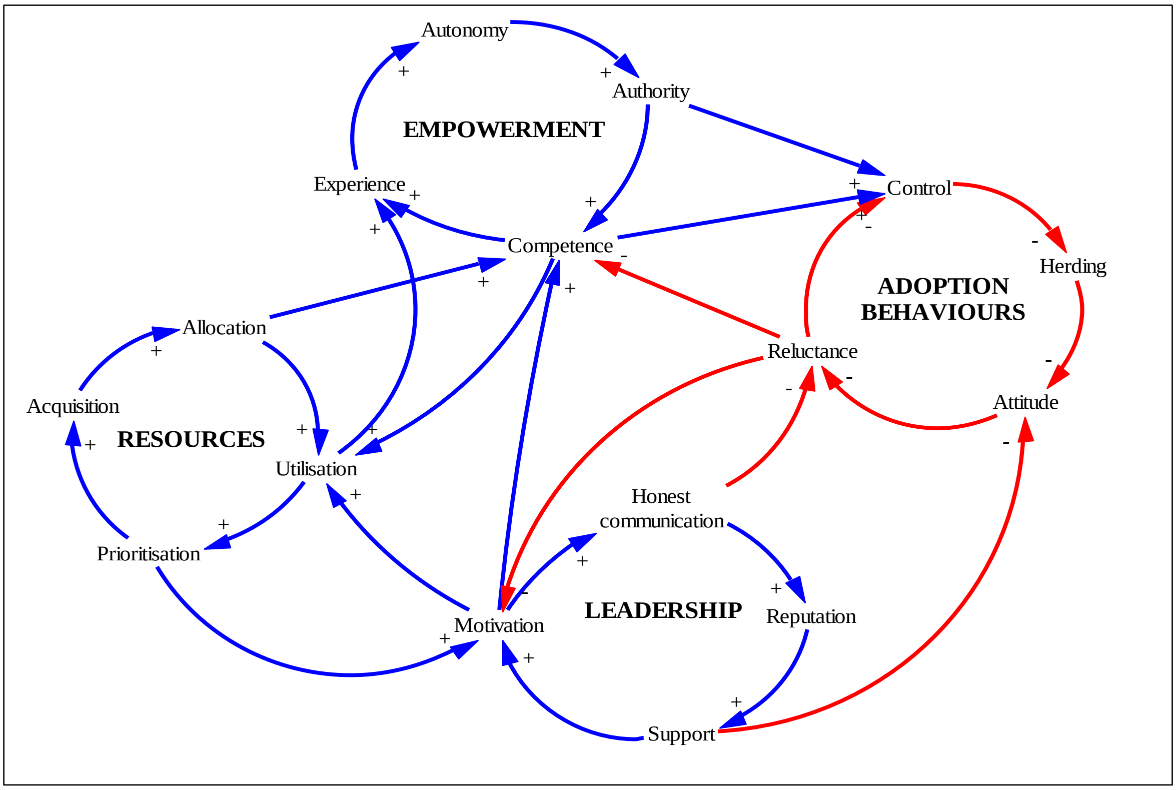
The fourth step involved naming the relationships and mapping the empirical data to these relationships. The process began with naming the relationships between concepts, for example Leadership acquires Resources, Resources increase Empowerment, and Empowerment enhances Adoption. This was followed by an implementation of these relationships on an appropriate NVIVO feature and the results of this implementation are depicted in Table 8.5.

Table 8.5 *A List of Named Relationships*

From name	Type	To name
Beliefs\Attitude	influences	Adoption behaviours
Beliefs\Empowerment	motivates	Adoption behaviours
Beliefs\Empowerment	enhances	Adoption behaviours
Beliefs\Interest	decreases	Beliefs\Resistance
Beliefs\Resistance	is associated with	Beliefs\Reluctance
Leadership	acquires	Resources
Leadership	facilitates	Beliefs\Empowerment
Leadership	influences	Adoption behaviours
Leadership	allocates	Resources
Leadership \Consultation	influences	Adoption behaviours
Resources	impacts	Adoption behaviours
Resources	impacts	Beliefs\Empowerment
Resources	motivates	Adoption behaviours
Skills	is associated with	Beliefs\Attitude

In step five, the results of the query matrix in step three (depicted in Table 8.3) were mapped to a Causal Loop Diagram (CLD) as depicted in Figure 8.1. To develop the CLD, The researcher followed the guidelines of Yearworth and White (2013), who emphasise the importance of demonstrating the mutual causality and feedback loops among concepts. Since the relationships between concepts were already established in step two, and the interconnections of key words in step three, what remained was to present a model that could demonstrate the complex interaction of these concepts in the HEI case. This model revealed the interlocking dynamics of ICT adoption, which are implicated in the structures leading to the 2nd order digital divide in the HEI case in Zimbabwe. Figure 8.1 shows the complex interactions among the interlocking dynamics of ICT adoption in the HEI in Zimbabwe.

Figure 8.1 *CLD of Interlocking Dynamics of Structures (informed by empirical data)*



In Figure 8.1, the elements having a positive influence were depicted by arrowed blue lines, while elements having a negative or contradictory influence were represented by arrowed red lines. For example, acquisition has a positive influence on allocation such that an increase in acquisition leads to an increase in allocation while a decrease in acquisition reduces allocation. An interesting example of a contradictory influence is seen where an increase in motivation leads to high confidence levels and reduces reluctance and while in the absence of motivation, confidence levels decrease leading to reluctance. In this case, while a positive influence initially reinforces, a negative influence then balances the feedback loop. Table 8.6 shows the results from testing these key concepts.

In the last step, the researcher employed a decision table in Table 8.6 to validate the credibility of the key concepts reflected in the CLD. The decision table has three parts: **conditions** consisting of Resources, Leadership, Adoption Behaviours and Empowerment; r**ules** involving

46 cases of research participants (identified as R1 to R46); and **action** referring to the willingness of participants to adopt ICTs.

The purpose of the content in Table 8.6 was to establish the consensus among the research participants, which is based on the principle of the coherence theory of truth. A coherence theory of truth refers to the truth of representations, which are coherent with other representations (Thagard, 2007). This was an essential method for inferring the participants' beliefs about the interlocking dynamics of ICT adoption at the HEI case. This method is founded on Cohen (1978) who emphasises the importance of coherence and mutuality in testing the truth of claims or propositions. The reliability of the propositions that the researcher formulated in the following sections are therefore guided by the principle defined by BonJour in Cross (1999) that a set of propositions is justified by the level of coherence, which must be stable over an elongated time frame.

To establish the coherence of truth involved several stages as follows:

1. The researcher categorised the questions included in interviews and group discussions according to the themes that emerged from the collected empirical data that were presented in section 7.3.
2. The responses of questions relating to each theme were analysed across all the 46 research participants.
3. All positive responses were assigned Y for "Yes" while the negative ones were assigned N for "No".
4. All the "Y"s were counted, and the percentages calculated for each theme.
5. All the themes that scored above 50% were consider for the formulation of propositions.

Table 8.6 *Decision Table of Interlocking Dynamics of ICT Adoption (informed by empirical data)*

	PARTICIPANTS																							
Conditions	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**P12**	**P13**	**P14**	**P15**	**P16**	**P17**	**P18**	**P19**	**P20**	**P21**	**P22**	**P23**	**%**
Strong leadership	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	**57**
Positive adoption behaviour	N	N	N	Y	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	**55**
Adequate resources	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	**99**
Relevant empowerment	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	N	N	**78**
Action																								
Willingness to adopt ICTs	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	

	PARTICIPANTS																							
Conditions	**P24**	**P25**	**P26**	**P27**	**P28**	**P29**	**P3N**	**P31**	**P32**	**P33**	**P34**	**P35**	**P36**	**P37**	**P38**	**P39**	**P40**	**P41**	**P42**	**P43**	**P44**	**P45**	**P46**	**%**
Strong leadership	Y	N	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y	**57**
Positive adoption behaviour	Y	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	**55**
Adequate resources	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	**99**
Relevant empowerment	N	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**78**
Action																								
Willingness to adopt ICTs	N	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	

Two exceptional scenarios were apparent from the content of Table 8.6, which are highlighted in yellow and green. The first (yellow) scenario showed a willingness to adopt ICTs despite rejecting three of the four associated conditions. Participant checking revealed that both P1 and P2 were Computer Science students, who are mandated to use computers in their studies; so, for this cohort, ICT resources were a sufficient condition for adopting ICTs as depicted in Figure 5.3.

The second scenario, (highlighted in green) showed unwillingness to adopt ICTs despite acceptance of the four conditions. Further probing revealed that the participants concerned, P12, and P17, who are lecturers in the departments of Statistics & Operations Research and Forest Resources & Wildlife Management, believed that the conditions specified are necessary but not sufficient for the adoption of ICTs, as adoption also depends on socialisation, which in this case is a process of learning from peers and mentors how to integrate ICTs in the education process.

Apart from these two exceptions, the general feeling among the participants (74%) was that the four conditions identified in Table 8.6 are both necessary and sufficient for the adoption of ICTs in the HEI case of Zimbabwe. It is against this background that the focus is now directed towards Leadership, Adoption Behaviours, Resources and Empowerment, the key interlocking dynamics of ICT adoption. These formed the significant constructs of a model that enhances Structuration Theory by modelling the additional structures used for theorising about the 2nd order digital divide in the HEI of Zimbabwe, a developing country. The subsequent sections provided a theoretical elaboration of these key findings by supporting them with empirical evidence and results from literature.

8.3.1 Leadership

Leadership has been conceptualised in the literature as a “nucleus of tendency, personality in action, induction of compliance, influence relation, power differential, persuasion, influence act, influence on goal achievement, status position, reinforcement, and initiation of structure*"* (Sarker & Lee, 2003, p. 815). This view of leadership is commonly discussed in the literature in relation to the transformational and transactional leadership styles (Avolio et al., 1999). In the empirical data, leadership was mentioned in discourses about management support, motivation, honest communication, and reputation, as indicated in the previous chapter.

The crucial role of **management support** was evident in departments where a significant level of ICT adoption was observed. For example, [C002] and [L005] commended their faculty dean for championing the adoption of ICTs. In comparison, the adoption of ICTs was slow in departments where there was little or no management support, as is evident from the following comments: "*CAT 5 cable a drum of 500m which can be used for all the labs costs less than US$200 but still it took for ever to get such resources for use*" [FG002]; "*the process of acquiring software is very difficult*" [L001]; "*there is no management support to encourage me to use the institutional systems*" [L009] and "*without doubt, management should be involved to give ICTs the prominence they deserve"* [C010].

The empirical data also revealed that ICT adoption depended on **honest communication** as observed in the comment that "*promises must be fulfilled*" [C004]. Participant [C007] indicated that as a department, they felt cheated by management's intention to take over the *ownership* of tablet PCs and WI-FI dongles that the department had privately acquired, following earlier misinformation that these would remain departmental and not institutional assets.

Another important aspect of leadership that emerged in the empirical data for this study was r**eputation**, as is evident in the following comments: "*equipment is there, most lecturers and teaching assistants have access to ICT devices especially their personal laptops*" [C011] and "*we try as a department to make ICT resources available to all those that require them*" [C010]. Some departments even encouraged students to buy their own laptops [L010] and connect them to the HEI network [FG001]. At the institutional level, it emerged that the leadership of the

HEI was encouraging the adoption of ICTs for use in e-learning as is evident in an email sent by NUST Vice Chancellor to all staff (Appendix Z).

A theme that was also popularly mentioned in discussions about training is **motivation**. While Appendices M through P provide evidence of invitations for ICT training, several participants stated that, "*there is a lack of ICT training, which increases the time taken to complete online tasks"* [C007]; "*I was never trained on how to use the institution education systems*" [L003]; "*there is limited ICT training for those who are joining the university for the first time*" [C011] and "we *need continuous training and refresher courses, not just train and go like what our ICT team does*" [C013]. The common feeling was that training provision is not adequate.

These findings were not unique to the present study. The importance of these leadership elements has been emphasised by leadership theorists like Avolio et al. (1999) who consider leadership to be a critical construct for work effectiveness. Lowe, Kroeck and Sivasubramaniam (1996) also found that leadership has a positive correlation with work performance.

Building on earlier leadership theories, existing studies support the idea that the successful adoption of ICTs depends on strong and committed leadership (Bingi, Sharma, & Godla, 1996; Sarker & Lee, 2003). For example, Tarafdar and Vaidya (2006) attribute the adoption of e-commerce in Indian companies to the commitment shown by their leadership. Kuo and Lee (2011) report that the success of adopting Knowledge Management Systems (KMS) in Taiwan companies was due to leadership support, while findings from a grounded theory based study by Lakshman (2007) show that leadership support is crucial for the adoption of KMS. Honest communication from the leadership was reported as a vital aspect of ICT adoption (Bingi et al., 1996; Sarker & Lee, 2003), while unreliable communication has a negative impact on digitisation initiatives (Ngwenyama & Hardt, n.d.).

Afshari et al. (2009) as well as Arokiasamy, Abdullah, and Ismail (2014) concur that the role of leadership is vital for motivating school teachers to adopt ICTs. The adoption of ICTs has also been attributed to an obsession with reputation and status (Teo et al., 2003; Zucker, 1987; Sun, 2013; Salge et al., 2015). Together, the evidence from empirical data and from literature prompted me to propose that,

P1: ***The adoption of ICTs in the HEI of a developing country is possible if there is a strong and committed leadership to champion the ICT initiative.***

This proposition is confirmed by the above-average participants' coherence theory of truth of calculated as 57% in respect of the association between leadership and ICT adoption depicted in Table 8.3. The study's empirical data also revealed that leadership style affected ICT adoption behaviours.

8.3.2 Adoption Behaviours

Discussions about Adoption Behaviours mostly referred to reluctance, control, attitude, and herd behaviour. For example, **reluctance** was reported in an extract from an email in appendix Z, which read: "c*oncerns have arrived in our inboxes that academics are resistive about online delivery platforms*". Similar sentiments related to NUST's student representative body, which was reported to be rejecting the e-learning method citing challenges of access to resources like electricity and computers (Muzira & Shoko, 2020). Several participants also stated that "*we can just call it inertia to technology because we were trained but still very few people are using Sakai in this department*" [L011]; "*the eLearning platform is not useful for my courses*" [L010] and "*I am old schooled, and I am happy using the traditional mode because it is good, and I have been doing it for the past 20 years*" [L012].

In the empirical data, challenges of **control** were evident in comments like "*Lecturers don't trust technology they say technology fails them*" [T005]; "*taking pictures or recording a* *lecturer teaching is taboo and is viewed as disrespectful*" [FG004]; "*Sakai does not understand learning behaviours, and study patterns to be able to help the students with challenging concepts*" [FG001]. One lecturer also observed that "*in online tests a guessing student can make it without knowing anything"* [L001] while students in [FG002] confessed that they sometimes copy and even write online tests for each other.

Attitude emerged as an important element of adoption behaviour, as is evident in the following narrative stories: "*I am so innovative and it's not a challenge to use ICTs since my first encounter with the computer was when I was in grade four*" [L008]; *"I am on the creative side and I strive to do things differently. So, I end up stretching and using my personal resources to try and do what I can for students so that I excel regardless of the environment and reach for the sky"* [L005] and "*I have young lecturers who go on study leave part time they give lectures to their students while they are there and they just project and interact with their students"* [C006].

The empirical data also pointed to **herd behaviour**, which Sun (2013) defines as the pressure to emulate the behaviour of peers in a reference group. Herd behaviour was visible in the following discourses: "*I am not using Sakai because I have not heard anyone who speaks gloriously about it*" [L007] and "*my colleagues say if you know your stuff there is no need for you to use a projector just talk it through"* [L003].

The empirical evidence that emerged from this study was not unique. Behavioural theories that include but are not limited to TPB (Ajzen, 1985), TAM (Davis, 1989) and DOI (Rogers, 1995) refer to behaviours which influence the adoption of ICTs. For example, TAM associates the intention to use ICTs with the perceived ease of use and perceived usefulness of the ICTs (Davis, 1989).

These empirical findings are also consistent with existing literature, which shows that adoption behaviours influence ICT adoption (Compeau & Higgins, 1995; Macredie & Mijinyawa, 2011). For example, Hee-Woong and Atreyi (2009) observe that users resist the adoption of Information Systems that incur increased switching costs. Macredie and Mijinyawa (2011) report on Small to Medium Enterprises (SME) that were reluctant to adopt Open Source Software (OSS) due to time constraints, while Keengwe et al. (2009) found that lecturers resisted ICTs as they perceived them to increase their workload.

Concerns about adoption behaviours involving control are reported in a study by Cox et al. (1999) who observed that teachers who did not adopt ICTs feared losing control of ICTs and of their classes. Macredie and Mijinyawa (2011) also observe a low adoption of OSS by SMEs due to control issues involving anxiety and low self-efficacy. Sibanda (2020) refers to lecturers who are sceptical about ICTs because they fear that ICTs could rob them of their academic freedom.

Literature pointed to attitude as an enabler or constrainer of ICT adoption (Pavlou & Fygenson, 2006; Turel, Serenko, & Giles, 2011; Davis, 1989b; Cox et al., 1999). Kisanjara et al. (2019) support the idea that attitude can negatively or positively affect the adoption of ICTs. Andersson and Grönlund (2009) identify attitude as influencing the adoption of e-learning systems in education, while Bhuasiri et al. (2012) confirm that a positive attitude is a critical factor for engaging in e-learning environments.

Studies on herd behaviour show that the adoption of ICTs is usually motivated by pressure from peers (Wang, Meister, & Gray, 2013). Herd behaviour is normally visible in environments of high uncertainty (Compeau & Higgins, 1995; Sun, 2013; Salge et al., 2015). For instance, Sun (2013) reports on how the adoption of emerging technologies was influenced by herd behaviour and the need to 'flow with the tide' as it were.

Taken together, the evidence from the empirical data and existing studies indicateed that while positive behaviours reinforce, negative behaviours discourage the adoption of ICTs. This observation led to the formulation of the following proposition:

P2: ***The successful adoption of ICTs in the HEI of a developing country context is possible if there are positive adoption behaviours.***

The credibility of this proposition is apparent from the decision table in Table 8.3, which depicts an above average calculation of (55%) coherence theory of truth regarding the association between adoption behaviours and the adoption of ICTs. Adoption behaviours were linked to the availability of adequate resources.

8.3.3 Resources

Historically, literature consider resources to be vital for the adoption of ICTs in organisations (Ranson et al., 1980). The empirical data analysis also pointed to time, funding, computers, projectors, anti-virus, and data analysis software as being among scarce resources hindering ICT adoption. These were mentioned in discourses involving resource acquisition, allocation, utilisation, and prioritisation as is demonstrated in the following sub-sections.

Resource acquisition was a recurrent theme in this study's empirical discourses as is evident in the following sample comments. "*The university is not sufficiently funded to purchase upcoming technologies"* [C012]; "*we are in an environment that is resource constrained and expenditure on software is not really an expenditure that is welcome*" [L001] and "*the prevailing economic challenges inhibit acquisition of ICTs"* [C007]. [L009] also observed that "*they [management] say that there is no money to buy us computers*" while [C010] confirmed that "*budgets do not priorities the acquisition of ICT equipment".* This impacts allocation.

R**esource allocation** emerged as a problematic issue revealed in comments like: "*there are power challenges here and when the generator comes they don't give us this side*" [C006] and "*we have less than 20 computers for use by over 400 students*" [FG013]. The chairmen [C010] and [C012] concurred that the allocation of resources was not uniform but depended on need, while [L009] and [L007] confirmed that the allocation of computers followed a first-come-first-served strategy. Limited allocation affects the utilisation of ICTs.

Resource utilisation also emerged from the empirical data involving participants who claimed that: *"I have young lecturers who go on study leave part time and they give lectures to their students while they are there, they just project and interact with their students"* [C006] and "*I know we were trained but still very few people are using sakai in this department*" [L011].

Concerning r**esource prioritisation,** the research participants revealed that that e-learning was not a priority for funding [T005] and acquisition of ICTs in general was not a priority [L001] and [C010]. Another participant stated that.

> *Such issues as WI-FI are not taken seriously or given priority because the students are said to have other resources such as the books. To complain about issues like this is taken just as one of those issues not taken seriously. They don't make it like a big issue*" [FG002].

It could be concluded from these comments that resources are an important condition for adopting ICTs in the HEI case. These observations support the view that resources either enable or constrain human activities (Govender & Chitanana, 2016; Njenga, 2018; Kisanjara et al., 2019). The importance of resources has made them an integral construct in theories such as Structuration Theory (Giddens, 1984), Adaptive Structuration Theory (AST) (Desanctis & Poole, 1994) and the duality of technology (Orlikowski, 1992).

Guided by such an emphasis on resources, several empirical studies recognise the importance of investing in adequate resources prior to adopting ICTs (Keengwe et al., 2009; Cox, Preston, & Cox, 2019; Touray, Salminen, & Mursu, 2013). For example, Salge et al. (2015) found that investing in resources was crucial to the adoption of hospital information systems, while Williams, Coles, Wilson, Richardson, and Tuson (2000) report that an investment in resources preceded the adoption of ICTs by teachers in Scottish schools.

Cox et al. (1999) observed that the level of ICT resource allocation influenced lecturers' adoption of ICTs. More recently, Kisanjara et al. (2019) found that the success of e-learning in Tanzania was determined by the level of ICT resource allocation. Similar findings showed that the adoption of emerging technologies in Zimbabwe's HEIs was dependent on the quantity of resources that were allocated (Khumalo & Baloyi, 2018).

Resource utilisation, which Comfort and Onaigho (2015) define as the art of properly using the tangible or intangible resources that are available, is a popular topic in the literature. The remarkable utilisation of ICTs has been reported in the educational institutions of some developing countries like Pakistan, Nepal, India, South Africa, and Nigeria. For example, Soomro et al. (2020) reports on the advanced utilisation of ICTs by university lecturers. Rana et al. (2020) reports on an improved use of ICTs in the education at Nepal's HEIs and Talikoti (2020) claim that ICTs are widely used in HEIs of Karnataka province in India. Nyahodza and Higgs (2017) acknowledge the wide adoption of library e-services by students of the University of Western Cape, while Comfort and Onaigho (2015) observe that there has been a remarkable utilisation of ICTs in Nigeria's HEIs.

Resource prioritisation is also a popular topic in the literature. Salge et al. (2015) observe that many organisations prioritise resources that facilitate business continuity. Empirical studies conducted in the context of developing countries refer to food, water and sanitation as high-priority resources (Bollou & Ngwenyama, 2008), supporting the impression that has been created in existing literature that ICTs are low-priority resources in developing countries (ITU, 2017). Literature shows that in developing countries, an investment in educational ICT infrastructure is not a high priority (Mukosa & Mweemba, 2019; Avgerou et al., 2016) For example, Saha and Zaman (2017) report that there is less prioritisation of emerging technologies by female students of Barisal university in Bangladesh. On a similar note, Sebbowa and Muyinda (2018) show that technical issues are not considered, resulting in the underutilisation of ICTs in HEIs. In Uganda it is claimed that use of ICTs in distance learning has not been prioritised (Muyinda et al., 2019).

These discussions have indicated the importance of resource acquisition, allocation, utilisation, and prioritisation in the adoption of ICTs, which led to the following proposition.

P3: ***The successful adoption of ICTs in the HEI of a developing country is possible if there is access to adequate ICT resources and backbone infrastructure.***

The credibility of this proposition is reflected in a 99% coherence theory of truth (as is evident in Table 8.3) that adequate resources are both necessary and sufficient for ICT adoption in the HEI case. Resources were thus central to the positive empowerment of ICT adopters.

8.3.4 Empowerment

Literature associates empowerment with several concepts, which include but are not limited to autonomy, authority, competence and experience (Kirkman & Rosen, 1999; Thomas & Velthouse, 1990; Kirkman, Rosen, Tesluk, & Gibson, 2004). Several participants referenced issues of **autonomy** when they stated that "*our lab has few computers and no ethernet cables, but they are so strict not to allow use of personal ethernet cables* [FG013]; "w*e are not permitted to install software of our choice on the institutional computers in the lab"* [FG002]*; "we are not allowed to use our personal laptops in the computer lab"* [FG010].

The empirical data also referred to **authority**, which is used in this study in relation to having rights or privileges. Participants stated that "*sometimes we are not given all the rights that you may need to use the full system features*" [L004; "*the university did not give me a computer since they recruited me but what I know is that when you are employed you must be given the* *tools to use*" [L007]; "*I have been waiting for a computer since I joined the institution in 2013 which makes it incredibly difficult for me to teach effectively*" [L009].

Competence was mentioned in discussions like, "*I could connect to the Internet but could not use those machines that have an Ubuntu operating system which I have never used so I was in that room for 5 minutes and came out angry*" [FG011]; "*the current systems hinder us from performing to our maximum*" [FG001] and "*in the HEI that awards Computer Science degrees why should we go and buy software from Microsoft instead of having students develop software and just customising it*" [FG002].

Research participants referred to issues of **experience** as they claimed that "*if you do not have your own computer you cannot practice concepts like dual booting when there are such controls around"* [FG001]; "*I prefer f2f because I am not technologically advanced".* [FG012]; "*most people think that only Computer Science students can learn through ICTs and that e-learning is a Computer Science thing*" [FG001].

These findings were consistent with existing literature, which shows that empowerment escalates the intention to adopt ICTs (Kakar, 2017; Kirkman & Rosen, 1999; Kirkman et al. 2004). For example, Williams et al. (2000) observe that the adoption of ICTs in Scottish schools was impeded by a lack of empowerment. Kirkman and Rosen (1999) acknowledge that ICTs are adopted more easily by teachers who are empowered, while Cox et al. (1999) argue that a lack of empowerment hinders the adoption of ICTs in schools. Maruping and Magni (2015) found that empowered team members were quick to adopt collaboration technologies, while Maas, Van Fenema, and Soeters (2018) observe that empowerment is positively correlated with the adoption of ERP systems. Empirical observations reported in the literature provide clear evidence that empowerment is closely associated with ICT adoption. For this reason, the researcher proposed that,

P4: ***The adoption of ICTs in the HEI case of a developing country is possible if users are empowered to use the implemented ICTs.***

The credibility of this proposition is supported by a calculated average of 78% coherence theory of truth regarding the close association of positive empowerment with ICT adoption, as reflected in Table 8.3. This section has provided evidence from the current study's empirical data as well as from literature to demonstrate that leadership, adoption behaviours, resources and empowerment are necessary and sufficient conditions for ICT adoption. These interlocking dynamics were implicated in structures leading to the 2nd order digital divide in the HEI of Zimbabwe and could be a serious oversight to ignore these constituent elements of structures that lead to the 2nd order digital divide in the HEI of Zimbabwe. The four elements of leadership, adoption behaviours, resources and empowerment thus formed the key constructs that should be factored into a model for theorising about the structures contributing to the 2nd order digital divide.

8.4 Developed Model of Structures

The model depicted in Figure 8.2 was derived from the empirical data for this research and literature as it was discussed in section 7.3, where the identified institutions, governance and beliefs explained. The researcher could therefore confidently conclude that this section of theoretical elaboration has resulted in the structuring of additional constructs to advance an existing but narrow theory (Fisher & Aguinis, 2017). The identified interlocking dynamics of ICT adoption enhanced the understanding of belief, institutional and governance structures, and by doing so extended the groundwork explanation of Structuration Theory's structures of signification, domination, and legitimation. The components depicted in Figure 8.2 provided an insightful overview of the complex structures leading to the 2nd order digital.

Figure 8.2 *A Model of Complex Structures implicated in the 2nd Order Digital Divide*

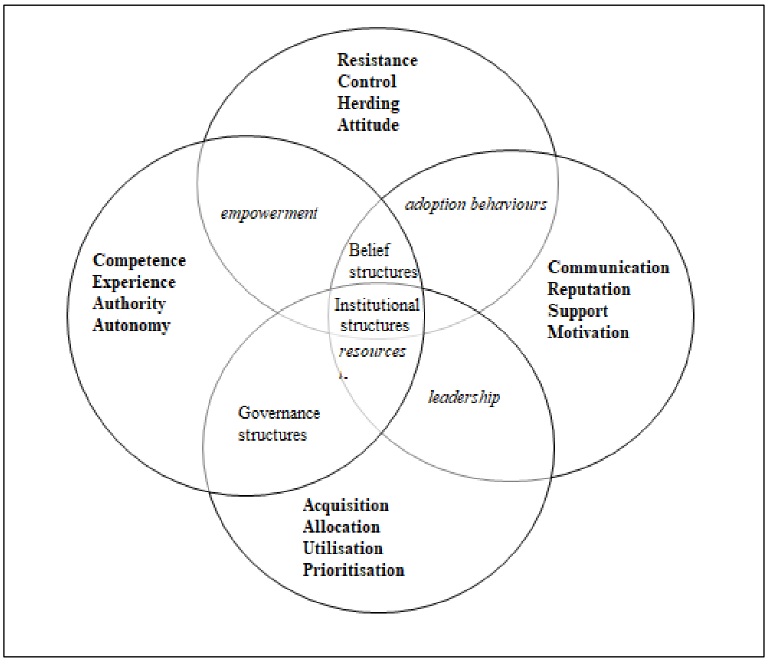


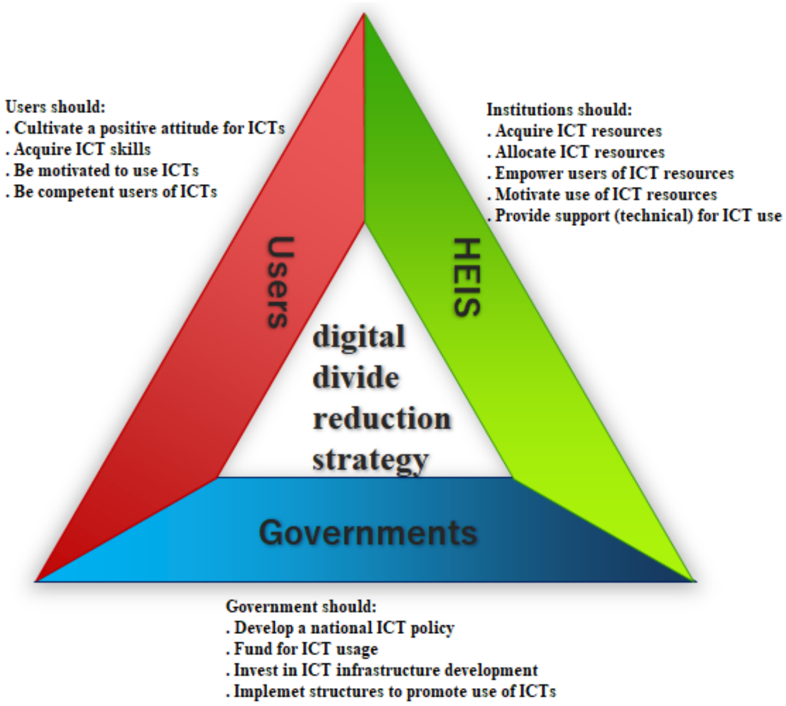
Figure 8.2 shows the complex institutional, governance and belief structures implicated in the 2nd order digital divide in a HEI of a developing country. These complex structures were deduced from the themes involving resources, leadership, context, and perceptions, which emerged from this study's empirical data and were discussed in section 7.2. From the complex structures also emerged the interlocking dynamics of ICT adoption, which included leadership, adoption behaviours, resources, and empowerment, which were outlined in section 8.3. It is apparent from Figure 8.2 that resources for example, were the key interlocking dynamics of ICT adoption because their acquisition, allocation, utilisation, and prioritisation depended on the institution leadership and the government. The level of access to resources further impacted the magnitude of user empowerment and their adoption behaviours leading to beliefs about adopting ICTs.

Together these structures and the interlocking dynamics of ICT adoption provided a holistic explanation of the 2nd order digital divide, which is an important phenomenon within developing countries. With the complex structures and the interlocking dynamics of ICT adoption in place, what remained was the development of the 2nd order digital divide reduction strategy, which is presented in the following section.

8.5 Developed Framework

The complex structures discussed in the previous section paved the way for developing a framework for reducing the 2nd order digital divide, particularly in HEIs within the developing countries. The previous discussion showed that HEIs, the government and users were key stakeholders implicated in the institutional, governance and belief structures, respectively. It was with this mindset that Figure 8.3 presented HEIs, government and users as the key stakeholders that are fundamental for reducing the 2nd order digital divide in the HEIs.

Figure 8.3 *Framework for Reducing the 2nd Order Digital Divide in HEIs*



Depicted in Figure 8.3 are HEIs, the government and the users, which were identified as the key stakeholders responsible for addressing the problem of the 2nd order digital divide. These three key stakeholders, which were deduced from the empirical data discussed in section 7.2 correspond to the identified complex institutional, government and belief structures that were explained in section 7.3 and presented as a model in Figure 8.2. The development of the framework in Figure 8.3 was a response to the research demands to bridge the widening digital divide (Njaya & Murangwa, 2017).

The inclusion of the three stakeholders in the framework shows that the reduction of the 2nd order digital divide depends on an inclusive effort from the HEIs, government and users. For example, the HEIs are responsible for the acquisition and allocation of ICT resources as well as the empowerment of users through facilitating for training, motivating the users, and providing them with necessary support., technically or otherwise. It is also worth noting that the inclusion of the government in the framework was informed by the realisation that it is the government responsibility to formulate national policies, provide HEIs with resources and to appoint leadership for such institutions. Furthermore, concerning policies, Njaya and Murangwa (2017) observe that while the national ICT policy refers to the promotion of ICTs in education, Zimbabwe does not have a specific policy on the development of ICT in education. The same authors claim that "the introduction of ICT in education has been haphazard, fragmented and consequently lethargic" (Njaya & Murangwa, 2017, pg44).

In addition to policy development, the government should fund for ICT resources, invest ICT infrastructure development, and the implementation of necessary structures to support usage of ICTs, all which are pre-conditions for reducing the digital divide (Cariolle, 2020). The inclusion of users in the framework was informed by the users' major role in the adoption of ICTs, which is defined by the users' attitude towards ICTs, competence of ICTs, experience with ICTs and their control of ICTs.

The discussion in this section presented an overview of the possible strategy for reducing the 2nd order digital divide, which included the HEIs, governments and users as the key stakeholders for this purpose. From this discussion, the researcher can therefore conclude that together, the complex structures depicted in Figure 8.2 and the developed framework shown in Figure 8.3 have provided answers for this research's questions.

8.6 Implications - Revisiting the Research Questions

This research sought to answer the following two questions regarding structures leading to and strategies for reducing the 2nd order digital divide in the HEI of a developing country.

RQ1: ***What structures lead to the 2nd order digital divide in HEIs of a developing country context?***

The detailed report of empirical findings that was presented in the previous chapter revealed two categories of structures that lead to the 2nd order digital divide in the HEI case. These categories involved both theory-driven and data-driven structures. The deductive reasoning process pointed to Structuration Theory's signification, domination, and legitimation structures as the foundation of the 2nd order digital divide.

Signification structures were mentioned in discussions involving the importance assigned to ICTs as tools for education. Although there were mixed feelings regarding the value of ICTs in education, the general feeling was that the ICTs implemented at the HEI had little or no value. This unfolded in participants' narrative stories stating that "*the department buys software that are not useful to us*" [FG011]; "*the eLearning platform is not useful for my courses*" [L010]; "*not all features of Sakai are useful"* [L002]; "*I have not heard anyone who speaks gloriously about that Sakai*" L007] and "*Sakai does not help me master the course concepts*" [FG001]. These comments revealed that structures of signification have been produced, which constrained the adoption of ICTs to result in the 2nd order digital divide in the HEI of Zimbabwe.

Domination structures were referenced in articulations involving power relations employed in the allocation and control of resources. Although there was a lack of consensus, many participants claimed that "*computers are not distributed equally*" [FG003]; "*the ICT resources are not fairly distributed*" [C001]; "*infrastructure is there but not adequately allocated.*" [C008]; "*I feel ICT resources are not evenly distributed*" [C003] and "*ICTs are not evenly distributed with some having been given computers while others were not*" [C006]. It was apparent from these comments that there were domination structures that constrain the adoption of ICTs leading to the 2nd order digital divide in this HEI of Zimbabwe.

Legitimation structures were mentioned in discourses involving moral order and the role of education in defining social roles and statuses. The general feeling was that the conditions of the HEI promote face-to-face learning rather than ICT-supported education methods as is evident from the following comments. "*We are still back then when lecturers are dictating notes*" [L006]; "*the classroom infrastructure supports the traditional method, and the electricity cuts makes it very difficult to use the ICT method*" [L005] and "*you get into a lecture room you find the power points are broken and can't even connect your laptop*" [L007]. These sample comments indicated that there are structures of legitimation which constrain ICT-supported education methods, leading to the 2nd order digital divide in the HEI of Zimbabwe.

While there was extensive empirical evidence to support Structuration Theory's structures of signification, domination and legitimation, these structures resulted in only a partial explanation of the 2nd order digital divide. An inductive reasoning process revealed that belief, institutional and governance structures were also implicated in the problem of the 2nd order digital divide in the HEI of Zimbabwe.

Belief structures were evident in the interlocking dynamics of ICTs involving adoption behaviours and empowerment. Common claims were that "*some lecturers just don't like using ICTs*" [T001] and "*there was resistance to adopting the Sakai eLearning platform*" [T004]. It was also revealed that many participants felt anxious about using ICTs because "*sometimes it is not easy to adapt to the new technologies because of the fear*" [L012]; "*people may not want* *to adopt new technology due to fear*” [C010] and “*some lecturers are reluctant to use ICTs and perceive that ICTs will take away their jobs*” [T004].

Attitude and peer pressure also emerged in the discussions as is evident in the following articulations: “*Use of ICTs is a question of attitude and it’s mostly intra-personal*” [C010]; “*it’s the attitude because people are used to their old ways and find it difficult to change towards ICTs”* [T003] and “*my colleagues do not motivate or influence me to use ICTs*” [L003]. These sample comments provided evidence that belief structures constrain the adoption of ICTs leading to the 2nd order digital divide in the HEI of Zimbabwe. It must be appreciated that such beliefs are fuelled by the structures inherent in the HEI.

Institutional structures were evident in discussions that involved mainly the HEI leadership who are responsible for acquiring and allocating resources, and who are also responsible for empowering adopters with the skills needed to use them. The following comments provided insight into the role of institutional structures in constraining the adoption of ICTs: “*ICTs are not adequate because of monetary matters*” [C012] and “*there are some bureaucratic challenges, the time it takes for one to request and to get an allocation of a computer is just too long*” [C013]. A lack of security within the HEI was also a cause of concern as indicated in the following arguments. “*we are sometimes scared to bring our own devices due to fear of losing them*” [FG004] and “ *while BYOD is good security is what I fear*” [L002]. Such comments implicate institutional structures in the 2nd order digital divide that is being experienced at the HEI case. Furthermore, it was reasonable to associate these institutional structures with the broader governing bodies and associated governance structures.

Governance structures were discussed in matters of resources that determine the educational culture. Participants made the following claims: “*the university is not sufficiently funded to purchase upcoming technologies*” [C012]; “*It is very difficult because we are in an environment that is resource constrained*” [L001]; “*this institution is in a region that is not* *given enough resources*" [FG001] and *"there is a rumour that the government is not investing and giving much funds to institutions in this region*" [FG002]. It also emerged that the HEIs' leadership is appointed by the country's government. It was therefore sensible to view the failures of the HEI leadership as reflecting the failures of the broader government. It was clear from these discourses that the governance structures constrain the adoption of ICTs and thus fuelled the 2nd order digital divide in the HEI of Zimbabwe.

This section has provided an answer to the question regarding the signification, domination, legitimation, belief, institutional and governance structures that lead to the 2nd order digital divide in the HEI of Zimbabwe. However, the following question regarding the reduction of the 2nd order digital divide in the HEI of Zimbabwe still remained to be answered:

RQ2: ***How can the 2nd order digital divide be reduced in HEIs of a developing country context?***

A number of recommendations emerged from the empirical data and the research literature which, if appropriately implemented, could reduce the 2nd order digital divide in this HEI cases as well as other HEI cases in similar circumstances. An inclusive strategy involving institutions of higher education, government, individual lecturers, and students could be required to achieve this, as is evident from the discussion that follows.

The recommendations that were made by the research participants challenged the **HEI** to prioritise ICTs by investing in adequate and relevant ICT resources. Such an intervention strategy could include partnering with ICT resource and network service providers, who could be responsible for providing ICTs and data at discounted rates. It was also recommended that resources should be shared among HEIs to spread the costs. Such suggestions were revealed in comments such as:, "*for the ICT initiative to be a success the management should start by investing in ICT infrastructure and equipment*" [L006]; "*the institution must partner with*

Telecoms companies like Liquid and Telone to improve Internet access at a reasonable price for students" [C013]; "*there is need for partnerships with private institutions that can bring about revenue generation and help improve ICT Infrastructure*" [C007]; "*the university can benefit from sponsorship/partnerships with ICT organizations like International Business Machines (IBM) Corporation , Commercial and Industrial Security Corporation (CISCO) for ICT resources and infrastructure*" [C010]; "*the university should just tighten the strings and state that on such a day we are starting to use this innovation without having to compromise and force them to use*" [T003]. The HEI leadership was also challenged to "*find the convenient time for training on the use of ICTs and to offer incentives for ICT use compliances*" [L004].

The research participants agreed that the **government** of the country had a key role to play in the reduction of the 2nd order digital divide in the Zimbabwe the HEIs. They believed that the country's government should assume responsibility for formulating a national ICT policy and for funding ICT-related development activities in state HEIs. Participants therefore stated that the *"government, through the Ministry of Higher and Tertiary Education must avail money to buy new ICT infrastructure and upgrade the network*" [C013] and "*the government must improve the electricity situation for the academic institutions so that it does not just go*" [L012].

Since the interlocking dynamics of ICT adoption included the constituent element of adoption behaviours, it would be a mistake to ignore the contributions of **individual lecturers and students** in reducing the 2nd order digital divide problem. The knowledge and enthusiasm of experienced ICT users could help to transform methods of teaching, learning and research, as is evident in articulations like "*there is need to change the attitude, perception and culture of people who view ICTs as communication and entertainment tools*" [C010], "*technophobia, resistance and fear can be reduced if the pros and cons of ICTs are explained*" [T004] and "*the best way to learn to use ICTs is to keep practicing*" [T002].

In this section the researcher provided answers to the two research questions regarding the structures leading to the 2nd order digital divide problem that exists in HEIs within developing countries, and the interventions that were needed in order to reduce the 2nd order digital divide problem within HEIs in developing countries. The contribution of these research findings to practice and to theory is discussed in the next section.

8.7 Conclusion

This chapter provided a theoretical elaboration of the empirical findings by contrasting the empirical findings with Structuration Theory's structures of signification, domination, and legitimation. The initial section highlighted the limitations of the theory-driven findings. The following section presented a model consisting of Leadership, Adoption Behaviours, Resources and Empowerment as the interlocking dynamics of ICT adoption. This was followed by a section that demonstrated how the fundamental explanation of the structures leading to the 2nd order digital divide in the HEI case hinged on these interlocking dynamics of ICT adoption. The chapter concluded by providing answers to the two research questions, thus paving the way for explaining the implications of the study findings with regard to practice as well as the corresponding explanatory contribution to theory.

Chapter 9: Conclusion and Recommendations

9.1 Introduction

The discussion presented in the preceding chapters has provided an explanation of the structures implicated in the problem of the 2nd order digital divide in the HEI of Zimbabwe. From this point onwards, is a recap of the activities that contributed to this research. This was an important exercise for understanding how an initially puzzling paradox has culminated in a holistic explanation of the structures that lead to the 2nd order digital divide in the HEI case.

Chapter 1 introduced a research challenge involving the 2nd order digital divide, which is a widespread problem in HEIs in developing countries. It was argued that despite the attempts that have been made to explain this 2nd order digital divide phenomenon, there remained an urgent need to address it. **Chapter 2** presented literature-based evidence to support the continued existence of an ICT usage gap that presents a significant problem in HEIs. This usage gap has resulted in a 2nd order digital divide, a phenomenon that has been ignored for too long and required scholarly attention.

With this problem in mind, the researcher believed that it was necessary to conduct a systematic literature review, the results of which were reported in **Chapter 3**. This report, referred to three profound gaps. The first gap related to the narrow explanations that account for the 2nd order digital divide, which has been associated with sociodemographic, sociocultural, and socioeconomic factors while ignoring the underlying structures leading to it. The second gap related to a lack of theoretical grounding for theorising about the 2nd order digital divide. The third gap related to the limited use of qualitative data collection methods, which could result in an insightful explanation for the 2nd order digital divide problem.

Following up on the theoretical gap, **Chapter 4** logically justified the suitability of Structuration Theory as a sensitising tool for collecting, analysing, and interpreting novel empirical data, to result in an in-depth understanding of the structures that lead to the 2nd order digital divide problem in the HEI of Zimbabwe. It was also argued that in addition to the concept of the duality of structure and agency, Structuration Theory's methodological richness afforded the collection of rich data that helped with the identification of preliminary structures leading to the 2nd order digital divide in the HEI case. **Chapter 5** provided a profound rationale to support the view that an interpretive philosophical ontology, epistemology, and methodology could yield an in-depth understanding of the socially constructed meanings and lived experiences that affected the adoption of ICTs in a real-life setting of a single HEI of Zimbabwe. It was also demonstrated how a deeper insight into the underlying structures could unfold naturally from interactions with a purposive sample of participants involving chairmen, lecturers, students, and technicians.

The preliminary findings that resulted from a directed content analysis of empirical data, were reported in **Chapter 6.** Four emergent themes were revealed, relating to Resources, Leadership, Context and Perceptions. These themes were mentioned frequently in verbal discourses with the research participants. **Chapter 7** then reported that the structures of signification, domination and legitimation defined in Structuration Theory had emerged from the identified themes, together with belief, institutional and governance structures which were influenced by the interlocking dynamics of ICT adoption. It was concluded that together, these structures provided a broader picture and a holistic explanation of the 2nd order digital divide.

However, a clearer understanding of how these structures led to the 2nd order digital divide required a closer investigation of the interlocking dynamics of ICT adoption. The four interlocking dynamics of ICT adoption, namely Leadership, Adoption Behaviours, Resources and Empowerment, unfolded from the theoretical elaboration described in **Chapter 8**. These four concepts became key constructs in a proposed model for theorising about ICT adoption in a complex setting of the HEI case. This chapter also recapped the research problem and the aim of this research, before re-iterating the rigour of the study and discussing the, implications of the findings for practice and theory. The research limitations and recommendations for future work are among the topics discussed in more detail in the following sections of this concluding chapter.

9.2 Restatement of the Research Problem

This research was conducted after observing that the adoption of ICTs as tools for education in many HEIs within developing countries is very low, creating a usage gap scientifically termed the 2nd order digital divide. It was noted that in attempting to explain the 2nd order digital divide, literature has frequently attributed this digital divide phenomenon to superficial sociodemographic, sociocultural and socioeconomic factors (Scheerder, et al., 2017; Njenga, 2018). However, a number of researchers have concluded that there are additional underlying structures behind this 2nd order digital divide (Steinmetz, 1998; Easton, 2010; Henderson et al., 2015; Zewge & Dittrich, 2017). In the context of HEIs, Mapuva (2009) and Schneckenberg (2009) observe that structures exist which constrain the adoption of ICTs, leading to the 2nd order digital divide in HEIs within developing countries.

Although an extensive search in the literature was conducted, the researcher could not find where these structures that lead to the 2nd order digital divide in HEIs within developing countries were explained. On the contrary, the only relevant literature that was found emphasised the need to identify these structures and to address this problematic phenomenon (Nikolaos et al., 2019; Henderson et al., 2015). Ii was with this mindset that identifying and explaining these underlying structures leading to the 2nd order digital divide in HEIs within developing countries became an inevitable goal of this study.

9.3 Restatement of the Research Aim and Objectives

The aim of this research was to address an existing gap in the literature by providing an explanation of the structures leading to the 2nd order digital divide, in particular within the HEI of Zimbabwe, a developing country. Two objectives needed to be met in order to fulfil this aim. The first objective was to identify the structures that contribute to the 2nd order digital divide in the HEI of a developing country. The second objective was to demonstrate how the 2nd order digital divide problem could be reduced in this HEI, as well as in other cases in similar circumstances. The research process that led to the successful fulfilment of these objectives is summarised in the next section.

9.4 Summary of Research Findings

Guided by Structuration Theory's concept of duality of structure and agency, the researcher collected rich qualitative data from a purposive sample of chairmen, lecturers, students, and technicians who were situated at NUST, the HEI in Zimbabwe. The researcher conducted a directed content analysis of the empirical data, which revealed a number of issues. With the help of existing literature, the researcher eliminated the non-significant issues and organised the relevant issues into four emergent themes involving Resources, Leadership, Context and Perceptions. Deductive logic was used to make sense of the empirical data by mapping these four themes to the key concepts of Structuration Theory. The search for structures revealed that there were signification, domination and legitimation structures that provided a partial explanation of the 2nd order digital divide in this HEI case.

The researcher then used inductive logic to reason from the empirical data, and discovered that additional hidden belief, institutional and governance structures emerged from this process. With those structures in place, what remained was to identify the interlocking dynamics of ICT adoption, which manifested as Leadership, Adoption Behaviours, Resources and Empowerment. Those four elements became the major constructs for modelling the interlocking dynamics of ICT adoption and enhancing Structuration Theory with regard to theorising about the structures of the 2nd order digital divide in the HEI case. These findings have filled a significant gap in the body of knowledge by providing a better explanation of the structures leading to the 2nd order digital divide, with a concomitant impact on Information and Communication Technologies for Development (ICT4D) research because the reduction of the 2nd order digital divide and the advancement in ICT education could result in the social and economic development. These were insightful findings for answering the research questions.

9.5 Re-iterating the Research Questions.

The analysis of the collected empirical data of this study resulted in important findings for answering the following are the two main questions concerning the structures leading to the 2nd order digital divide and the strategy for reducing it in HEIs.

RQ1: ***What structures lead to the 2nd order digital divide in HEIs of a developing country context?***

The discussion in Chapter 7 revealed the process of deductive logic resulted in the identification of structures of signification, domination, and legitimation, which are defined in Giddens' Structuration Theory. The results from an inductive logic then pointed to additional institutional, government and belief structures. It was argued that together these structures, which were explained in section 7.3 have contributed to the 2nd order digital divide, which is more prominent in developing countries and require to be addressed by answering the following second question.

RQ2: ***How can the 2nd order digital divide be reduced in HEIs of a developing country context?***

Findings from the empirical data of this research pointed to the main interlocking dynamics of adopting ICTs, which were discussed in detail in section 8.3. An insightful strategy for reducing the 2nd order digital divide in HEIs was derived from the key concepts that formed the interlocking dynamics of ICT adoption, which were presented in Figure 8.2. The identified concepts facilitated the development of a framework composed of HEIs, governments and users as the key components that are fundamental for reducing the 2nd order digital divide. The triad framework presented in section 8.4 demonstrated that it could be possible to reduce the widening 2nd order digital divide provided the triad relating to HEIs, governments and users each played their anticipated roles. Answers to the two research questions have implications on the results of this research and any other similar research.

9.6 Implications of the Research Findings

The implications of the research findings are usually evaluated based on the evidence of rigour and the relevance of those findings. Literature has documented several approaches that lead to rigorous research.

9.6.1 Claim for Rigour.

In order to fulfil the criteria for rigour that are presented in Table 5.7, the researcher conducted a systematic process of collecting and analysing data, which was explained in Chapters 5 to 7. Those chapters demonstrated that the findings of this research were based on evidence from multiple sources, which included experiences and narratives from interviews, focus group discussions, institutional documents, and observations. The coherence theory of truth was also employed to establish the consensus of data collected from a heterogeneous sample of participants, which included chairmen, lecturers, students, and ICT technical staff. Track of all the collected evidence was kept in a database, which facilitated the storage, indexing and analysis of the research data.

Together these methods of data collection and analysis and the different types of theorising that were applied, enabled this study to satisfy the anticipated high academic standards. This rigorous and systematic accumulation of empirical evidence resulted in

I. *The development of a model of interlocking dynamics of ICT adoptions*, which is depicted in Figure 8.1,

II. *An explanation of the structures that contribute to the 2nd order digital divide in a HEI in a developing country shown as a model in Figure 8.2, and*

III. *A proposed conceptual framework for reducing the digital divide in HEIs*, which is shown in Figure 8.3.

The value of these findings is evident in the satisfaction of the claim of relevance.

9.6.2 Claim of Relevance.

Research findings must be relevant for them to be accepted by a community of researchers. The goal of this research was to identify and explain the structures that contribute to the 2nd order digital divide in its entirety and was satisfied in two ways. First, Structuration Theory provided the platform for identifying the initial structures of signification, domination, and legitimation, which provided the foundation for uncovering deeper belief, institutional and governance structures. Together, these structures complemented each other to result in a holistic explanation of the structures that lead to the 2nd order digital divide in the HEI case. This means that future research can take these structures into account when discussing the 2nd order digital divide phenomenon.

The second aspect of relevance involved the identification of the key interlocking dynamics of ICT adoption, which led to a model for theorising about the 2nd order digital divide and the framing of interventions for reducing the 2nd order digital divide. The model that was developed afforded researchers a better understanding of the complex process of adopting ICTs in the context of a developing country. The intervention framework that was suggested could also enable HEI policy-makers to focus on the key fundamental elements that need to be considered in the process of adopting ICTs in order to reduce the digital divide in HEIs. This study's findings contributed to the body of knowledge in practice and theory in several ways as demonstrated in the next section.

9.7 Contributions of the Study

The findings from this study made two noteworthy contributions, firstly to practice and secondly to theory, which are discussed in the following sub-sections.

9.7.1 Practical Contribution

The most valuable practical contribution of this research is the identification of belief, institutional and governance structures, which extend Structuration Theory's previously defined structures of signification, domination, and legitimation. These empirical findings, viewed in conjunction with Structuration Theory's previously defined structures, afford a holistic explanation of the 2nd order digital divide, a problem that is significant in HEIs within Zimbabwe and other developing countries of similar circumstances.

A further practical contribution related to the roles of Leadership, Adoption Behaviours, Resources and Empowerment as the interlocking dynamics of ICT adoption. These four elements influenced and explained ICT adoption beyond the taken-for-granted sociodemographic, socioeconomic, and sociocultural factors that currently dominate the ICT adoption literature.

The final contribution to practice is a framework that outlines the components of an intervention strategy for reducing the 2nd order digital divide in the HEI case. This intervention strategy contains guidelines for the successful adoption of ICTs involving the HEIs' leadership, the country's government, and the individual lecturers and students. These findings could draw the attention of HEI decision makers to the key elements required for the successful adoption of ICTs and could thus help to reduce the problematic 2nd order digital divide at their institutions. These findings also extend the ICT4D literature by explaining the interlocking dynamics of ICT adoption; and extend the digital divide literature by explaining the structures leading to the 2nd order digital divide.

In addition to contributing to practice, the research findings made an explanatory contribution to theory, which is discussed in the following section. This theoretical contribution involved the adoption of Structuration Theory as a lens, the modelling of the interlocking dynamics of ICT adoption, and an extension to the structures that were previously defined in Structuration Theory.

9.7.2 Theoretical Contribution

This study's findings made an explanatory contribution to theory in three discrete ways. First, Figure 8.1 depicted a causal loop diagram which revealed the complex interactions of concepts that are implicated as the interlocking dynamics of ICT adoption in the HEI case. Figure 8.2 subsequently demonstrated how the key constructs of Leadership, Adoption Behaviours, Resources and Empowerment interacted to influence the adoption of ICTs in the HEI case. The graphical representation of these interlocking dynamics of ICT adoption enhanced the reader's understanding of the underlying structures leading to the 2nd order digital divide in the HEI of Zimbabwe; and could also apply to HEIs in other developing countries with similar conditions.

The second explanatory contribution to theory involved the adoption of Structuration Theory to guide the collection, analysis, and interpretation of data. Structuration Theory provided a starting point for theorising about the 2nd order digital divide phenomenon. The underlying concept of duality of structure and agency enabled the researcher to uncover the underlying structures of signification, domination, and legitimation, which constrained the adoption of ICTs to result in the 2nd order digital divide in the HEI case.

The third explanatory contribution to theory was to extend Structuration Theory by including the additional structures of Belief, Institution and Governance (as depicted in Figure 8.2), which were derived from the interlocking dynamics of ICT adoption shown in Figure 8.1. Together, these findings were of profound significance for ICT4D researchers and HEI policy-makers. These findings could also help to facilitate the adoption and use of ICTs in challenging social contexts such as that presented by the current COVID-19 pandemic, which has made it almost impossible for educational activities to occur in physical classroom settings.

Despite achieving the goal of identifying and explaining the structures as well as the intervention strategies for reducing the 2nd order digital divide, these findings should be interpreted with some caution due to the limitations presented in the next section.

9.8 Limitations of the Study

These findings could be affected by at least five limitations. First, the research was conducted at the HEI where the researcher is currently employed as a lecturer, and it is possible that an element of bias could be present in the findings. Second, the purposive sampling of participants from a single HEI could be susceptible to biases in their responses. Third, the relatively small sample and the specific context of the research could limit the generalisability of the research findings. Fourth, the fact that this was a qualitative study made it vulnerable to validity concerns. Last, the presented model of the interlocking dynamics of ICTs, and the intervention strategy for reducing the 2nd order digital divide, are yet to be tested.

The researcher, however, implemented counter measures to try and minimise any biases by verifying empirical findings with multiple data sources. The researcher was careful to remain non-manipulative and to avoid the possibility of influencing the participants' responses. The researcher also shared the thesis on the institutional "team drive" repository to afford peers an opportunity to review the findings. To enhance validity, the researcher employed the sampling for heterogeneity technique, which involved selecting informants across the HEI who were known to have had prior exposure to ICT-supported education. The coherence theory of truth, in which the mutual elements across various cohorts were considered as the crucial dynamics that impact the adoption of ICTs was also employed. To counter possible generalisability concerns, the researcher made every effort to relate the research findings to an existing theory, which was eventually extended. This extension involved the addition of three new structures to Structuration Theory's basic structures, as well as the identification of four inter-related constructs for modelling the interlocking dynamics of ICT adoption.

With these counter measures in place, the researcher could confidently conclude that the study's findings were credible (valid), confirmable (reliable), dependable (trustworthy) and transferable (generalisable). However, there will always be room for future work on the area of study, as is illustrated in the following section.

9.9 Recommendations for Future Work

The present study has contributed to theory and practice by identifying the interlocking dynamics of ICT adoption and the structures leading to the 2nd order digital divide, However, further research could address the same or similar questions using an empirical situation within a different context. There are, therefore, additional opportunities for future work based on the already collected data (see suggestions made in the text), plus testing the model and/or framework within NUST or another HEI.

9.10 Conclusion

This research was conducted in response to the researcher's personal confrontations with the puzzling situation of a paradox of the 2nd order digital divide in the HEI of Zimbabwe. The researcher's 15 years of working within the HEI of this developing country enabled the observation that ICT adoption was at an early stage. These observations were consistent with literature, which reported minimal usage of ICTs in HEIs within developing countries when compared to the trend in HEIs within developed countries. This trend of low ICT usage persists despite the existence of a wealth of ICT affordances that are documented in the literature.

The researcher was therefore determined to search for answers in the literature, which however failed the researcher by simply attributing the 2nd order digital divide to surface-level sociodemographic, sociocultural, and socioeconomic factors. This apparent gap in the literature compelled the researcher to embark on a journey to discover the hidden structures leading to the 2nd order digital divide. This goal was fulfilled by employing the capabilities of Structuration Theory's concept of the duality of structure and agency as the appropriate sensitising tool for collecting, analysing, and interpreting the empirical data. The researcher engaged in a prolonged process of collecting rich data about the social construction of meanings and the lived experiences of a purposive sample of participants who were situated in the real-life setting of a single HEI case in Zimbabwe.

In conclusion, unearthing the key constructs of the resultant model of the interlocking dynamics of ICT adoption made a fundamental contribution towards uncovering the hidden Belief, Institutional and Governance structures leading to the 2nd order digital divide at the HEI case. Together with Structuration Theory’s structures of signification, domination and legitimation, these structures resulted in an in-depth understanding of a paradox of the 2nd order digital divide in the studied HEI, which could be applicable to other cases in similar circumstances. These insightful findings have contributed to practice and theory for the benefit of ICT4D and digital divide researchers as well as HEI policy-makers.

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Appendices

Appendix A: GDP by country

Ranking	Economy	Atlas methodology (US dollars)	Ranking	Economy	Purchasing power parity (international dollars)
1	Switzerland	85,500	1	Macao SAR, China	*123,290* [i]
2	Norway	82,500	2	Qatar	94,170
3	Macao SAR, China	*78,640*	3	Singapore	92,020
4	Isle of Man	*76,340*	4	Luxembourg	77,570
5	Luxembourg	73,910	5	Switzerland	72,390
6	Iceland	72,850	6	United Arab Emirates	70,240
7	United States	65,760	7	Norway	69,610
8	Qatar	63,410	8	Ireland	68,050
9	Denmark	63,240	9	Brunei Darussalam	66,410
10	Ireland	62,210	10	United States	65,880
11	Singapore	59,590	11	Hong Kong SAR, China	65,600
12	Sweden	55,840	12	Denmark	61,410
13	Australia	54,910	13	Iceland	61,170
14	Netherlands	53,200	14	Netherlands	59,890
15	Austria	51,300	15	Kuwait	*59,720*
16	Hong Kong SAR, China	50,840	16	Austria	59,060
17	Finland	49,580	17	Germany	57,690
18	Germany	48,520	18	Sweden	57,300
19	Belgium	47,350	19	Belgium	54,730
20	Cayman Islands	*47,140*	20	Australia	51,560
21	Canada	46,370	21	Finland	51,210
22	United Arab Emirates	43,470	22	Canada	50,810
23	Israel	43,290	23	France	50,390
24	New Zealand	42,670	24	Saudi Arabia	49,400
25	France	42,400	25	United Kingdom	48,040
26	United Kingdom	42,370	26	Japan	44,780
27	Japan	41,690	27	Italy	44,580
28	Italy	34,460	28	Bahrain	44,140
29	Kuwait	*34,290*	29	Korea, Rep.	43,430
30	Korea, Rep.	33,720	30	New Zealand	42,710
31	Brunei Darussalam	32,230	31	Spain	42,300
32	Bahamas, The	31,780	32	Israel	42,140
33	Spain	30,390	33	Malta	41,690
34	Cyprus	27,710 [a]	34	Cayman Islands	*41,640*
35	Malta	27,290	35	Czech Republic	40,660
36	Aruba	*26,810*	36	Slovenia	40,070
37	Turks and Caicos Islands	*26,740*	37	Cyprus	39,830 [a]
38	Slovenia	25,750	38	Estonia	38,010
39	Estonia	23,220	39	Lithuania	37,010
40	Portugal	23,080	40	Aruba	*36,300*
41	Saudi Arabia	22,850	41	Bahamas, The	35,760
42	Bahrain	22,110	42	Portugal	35,600
43	Czech Republic	22,000	43	Slovak Republic	33,680
44	Puerto Rico	21,970	44	Hungary	32,750
45	Greece	20,320	45	Poland	32,710
46	Curaçao	*19,610*	46	Romania	31,860
47	Slovak Republic	19,320	47	Latvia	31,770
48	St. Kitts and Nevis	19,030	48	Greece	31,350
49	Lithuania	18,990	49	Sint Maarten (Dutch part)	*31,340*
50	Latvia	17,730	50	Panama	30,600
51	Barbados	17,380	51	Croatia	29,520
52	Palau	*17,260*	52	Seychelles	29,300
53	Trinidad and Tobago	16,890	53	Malaysia	28,680
54	Seychelles	16,870	54	Oman	28,590
55	Antigua and Barbuda	16,660	55	Russian Federation	28,270 [d]
56	Uruguay	16,230	56	Turkey	27,410
57	Hungary	16,140	57	Trinidad and Tobago	26,950
58	Oman	15,330	58	Mauritius	26,410
59	Poland	15,200	59	Turks and Caicos Islands	*26,210*
60	Chile	15,010	60	St. Kitts and Nevis	25,920
61	Panama	14,950	61	Curaçao	*25,660*
62	Croatia	14,910	62	Puerto Rico	24,240 [b]

Ranking	Economy	Atlas methodology (US dollars)	Ranking	Economy	Purchasing power parity (international dollars)
63	Nauru	14,230	63	Chile	24,140
64	Mauritius	12,740	64	Kazakhstan	24,050
65	Romania	12,630	65	Bulgaria	23,880
66	Costa Rica	11,700	66	Montenegro	23,070
67	Russian Federation	11,260 d	67	Argentina	22,060 c
68	Argentina	11,200 c	68	Antigua and Barbuda	21,500
68	Malaysia	11,200	69	Uruguay	21,120
70	St. Lucia	11,020	70	Mexico	19,810
71	China	10,410	71	Palau	*19,600* b
72	Grenada	9,980	72	Belarus	19,340
73	Maldives	9,650	73	Costa Rica	19,250
74	Turkey	9,610	74	Thailand	18,520
75	Mexico	9,430	75	Dominican Republic	18,280
76	Bulgaria	9,410	76	Serbia	17,960
77	Brazil	9,130	77	Maldives	17,880
78	Montenegro	9,010	78	Nauru	17,790 b
79	Kazakhstan	8,810	79	Botswana	17,110
80	Dominica	8,090	79	North Macedonia	17,110
80	Dominican Republic	8,090	81	China	16,740
82	Botswana	7,660	82	Grenada	16,250
83	Libya	7,640	83	Libya	16,090 b
84	Lebanon	7,600	84	Bosnia and Herzegovina	15,770
85	St. Vincent and the Grenadines	7,460	85	Barbados	15,730
86	Thailand	7,260	86	Lebanon	15,260 b
87	Gabon	7,210	87	Suriname	15,200
88	Serbia	7,020	88	Colombia	15,150
89	Peru	6,740	89	St. Lucia	15,140
89	Turkmenistan	*6,740*	90	Georgia	15,020 e
91	Colombia	6,510	91	Brazil	14,850
92	Equatorial Guinea	6,460	92	Equatorial Guinea	14,600
93	Belarus	6,280	93	Iran, Islamic Rep.	*14,560*
94	Bosnia and Herzegovina	6,150	93	Turkmenistan	*14,560* b
95	Ecuador	6,080	95	Armenia	14,460
96	South Africa	6,040	96	Gabon	14,420
97	North Macedonia	5,910	97	Azerbaijan	14,360
98	Fiji	5,860	98	Albania	14,350
99	Iraq	5,740	99	Ukraine	13,750 d
100	Tuvalu	5,620	100	Moldova	*13,280* g
101	Suriname	5,540	101	Fiji	13,260
102	Paraguay	5,510	102	Sri Lanka	13,230
103	Iran, Islamic Rep.	*5,420*	103	St. Vincent and the Grenadines	12,880
104	Jamaica	5,250	104	Peru	12,760
105	Albania	5,240	105	Paraguay	12,730
106	Guyana	5,180	106	South Africa	12,630
107	Namibia	5,060	107	Dominica	12,460
108	Marshall Islands	*4,660*	108	Kosovo	12,090 b
109	Georgia	4,740 e	109	Indonesia	11,930
110	Armenia	4,680	110	Egypt, Arab Rep.	11,810
111	Kosovo	4,640	111	Algeria	11,530
112	Guatemala	4,610	112	Ecuador	11,500
113	Azerbaijan	4,480	113	Mongolia	11,370
114	Belize	4,450	114	Iraq	11,280
115	Jordan	4,300	115	Tunisia	10,800
115	Tonga	*4,300*	116	Bhutan	*10,670*
117	Samoa	4,180	117	Jordan	10,240
118	Indonesia	4,050	118	Philippines	10,200
119	Sri Lanka	4,020	119	Guyana	9,900
120	El Salvador	4,000	120	Jamaica	9,770
121	Algeria	3,970	121	Namibia	9,750
122	Moldova	*3,930* g	122	Bolivia	8,910
123	Philippines	3,850	123	Guatemala	8,850 i
124	Mongolia	3,780	124	El Salvador	8,700

Ranking	*Economy*	**Atlas methodology** (US dollars)	*Ranking*	*Economy*	**Purchasing power parity** *(international dollars)*
125	West Bank and Gaza	*3,710*	125	Lao PDR	7,960
126	Cabo Verde	3,630	126	Eswatini	7,940
127	Eswatini	3,590	127	Vietnam	7,750
128	Djibouti	3,540	128	Morocco	7,680 f
129	Bolivia	3,530	129	Uzbekistan	7,400 b
130	Micronesia, Fed. Sts.	*3,400*	130	Cabo Verde	7,310
131	Ukraine	3,370 d	131	India	6,960
132	Tunisia	3,360	132	West Bank and Gaza	*6,740*
133	Kiribati	3,350	133	Belize	6,630
134	Morocco	3,190 f	134	Tonga	*6,510* b
135	Vanuatu	3,170	135	Samoa	6,490 b
136	Angola	3,050	136	Angola	6,390
137	Bhutan	*2,970*	137	Tuvalu	6,170 b
138	Papua New Guinea	2,780	138	Djibouti	5,980
139	Egypt, Arab Rep.	2,690	139	Ghana	5,510
140	Lao PDR	2,570	139	Honduras	5,510
141	Vietnam	2,540	141	Nicaragua	5,490
142	Honduras	2,390	142	Mauritania	5,350
143	Côte d'Ivoire	2,290	143	Côte d'Ivoire	5,290
144	Ghana	2,220	144	Pakistan	5,210
145	India	2,130	145	Bangladesh	5,190
146	Solomon Islands	2,050	146	Nigeria	5,170
147	Nigeria	2,030	147	Myanmar	5,160
148	São Tomé and Principe	1,960	148	Marshall Islands	*5,090* b
149	Bangladesh	1,940	149	Kyrgyz Republic	5,070
150	Nicaragua	1,910	150	Timor-Leste	4,730 b
151	Timor-Leste	1,890	151	Kiribati	4,650 b
152	Uzbekistan	1,800	152	Papua New Guinea	4,470 b
153	Congo, Rep.	1,750	153	Kenya	4,420
153	Kenya	1,750	154	Cambodia	4,180
155	Mauritania	1,660	155	Tajikistan	4,100
156	Pakistan	1,530	156	São Tomé and Principe	4,090
157	Cameroon	1,500	157	Sudan	3,990
158	Cambodia	1,480	158	Cameroon	3,730
159	Senegal	1,450	159	Micronesia, Fed. Sts.	*3,640* b
159	Zambia	1,450	160	Nepal	3,600
161	Comoros	1,420	161	Zambia	3,580
162	Myanmar	1,390	162	Senegal	3,440
162	Zimbabwe	1,390	163	Benin	3,390
164	Lesotho	1,360	164	Vanuatu	3,310 b
165	Benin	1,250	165	Lesotho	3,290
166	Kyrgyz Republic	1,240	166	Comoros	3,220
167	Nepal	1,090	167	Congo, Rep.	3,060
168	Tanzania	1,080 h	168	Zimbabwe	2,730
169	Tajikistan	1,030	169	Tanzania	2,700 h
170	Guinea	950	170	Guinea	2,520
171	Yemen, Rep.	*940*	171	Mali	2,360
172	Mali	880	172	Solomon Islands	2,350 b
173	Ethiopia	850	173	Afghanistan	2,330 b
174	Guinea-Bissau	820	174	Ethiopia	2,300
174	Rwanda	820	175	Gambia, The	2,260
176	Burkina Faso	790	176	Rwanda	2,240
176	Haiti	790	177	Burkina Faso	2,220
178	Uganda	780	177	Guinea-Bissau	2,220
179	Gambia, The	740	179	Uganda	2,210
180	Chad	700	180	Haiti	1,790
181	Togo	690	181	Sierra Leone	1,670
182	Sudan	590	181	Togo	1,670
183	Liberia	580	183	Madagascar	1,660
184	Niger	560	184	Chad	1,620
185	Afghanistan	540	185	Liberia	1,320
186	Central African Republic	520	186	Mozambique	1,300

Gross national income per capita 2019, Atlas method and PPP

Ranking	*Economy*	**Atlas methodology** (US dollars)	*Ranking*	*Economy*	**Purchasing power parity** *(international dollars)*
186	Congo, Dem. Rep.	520	187	Niger	1,250
186	Madagascar	520	188	Congo, Dem. Rep.	1,110
189	Sierra Leone	500	189	Malawi	1,080
190	Mozambique	480	190	Central African Republic	1,060
191	Malawi	380	191	Burundi	780
192	Burundi	280	192	American Samoa	-
	American Samoa	- l		Andorra	-
	Andorra	- l		Bermuda	-
	Bermuda	- l		British Virgin Islands	-
	British Virgin Islands	- l		Channel Islands	-
	Channel Islands	- l		Cuba	-
	Cuba	- l		Eritrea	-
	Eritrea	- k		Faroe Islands	-
	Faroe Islands	- l		French Polynesia	-
	French Polynesia	- l		Gibraltar	-
	Gibraltar	- l		Greenland	-
	Greenland	- l		Guam	-
	Guam	- l		Isle of Man	-
	Korea, Dem. People's Rep.	- k		Korea, Dem. People's Rep.	-
	Liechtenstein	- l		Liechtenstein	-
	Monaco	- l		Monaco	-
	New Caledonia	- l		New Caledonia	-
	Northern Mariana Islands	- l		Northern Mariana Islands	-
	San Marino	- l		San Marino	-
	Sint Maarten (Dutch part)	- l		Somalia	-
	Somalia	- k		South Sudan	-
	South Sudan	- k		St. Martin (French part)	-
	St. Martin (French part)	- l		Syrian Arab Republic	-
	Syrian Arab Republic	- k		Venezuela, RB	-
	Venezuela, RB	- l		Virgin Islands (U.S.)	-
	Virgin Islands (U.S.)	- l		Yemen, Rep.	-
	World	**11,570**		**World**	**17,581**
	East Asia & Pacific	11,726		East Asia & Pacific	18,422
	Europe & Central Asia	25,163		Europe & Central Asia	36,557
	Latin America & Caribbean	8,775		Latin America & Caribbean	16,202
	Middle East & North Africa	7,994		Middle East & North Africa	17,402
	North America	63,778		North America	64,339
	South Asia	2,019		South Asia	6,526
	Sub-Saharan Africa	1,550		Sub-Saharan Africa	3,796
	Low income	792		Low income	2,456
	Lower middle income	2,189		Lower middle income	6,793
	Upper middle income	9,074		Upper middle income	17,232
	High income	45,307		High income	52,322

Appendix B: Summary of Literature Review Findings

Empirical studies (2010-2019)	Theory/ Model	Methodology / participants / Context	Findings
Gameel and Gwinn (2019), When it comes to MOOCs, where you are from makes a difference. Computers & Education 136, 49–60	Resources and appropriation theory.	Survey (online)/ 2882 learners/ MOOCs universities, Arab States region, Europe, Latin America, the Caribbean, and North American regions.	Investigated the learners' readiness to engage in a MOOCs based learning. Results show that the region, self-efficacy and locus of control influence the learner's engagement with MOOCs.
Kaniaru, Karani, and Mirie (2018), Utilization of Blended Approach Mode in Teaching and Learning for Undergraduate Nurses in Kenya. American Journal of Nursing Research, 2018, Vol. 6, No. 6, 466-470.	N/A	Mixed method / 486 lecturers and students / School of nursing in Kenya	Explored the factors influencing engagement in blended learning. Blended learning is affected by lack of confidence on the e-learning system due to system complexity.
Chirwa (2018), Access and use of internet in teaching and learning at two selected teachers' colleges in Tanzania. IJEDICT, Vol. 14, Issue 2, pp. 4-16.	N/A	Mixed method / 1 college principal, two ICT system administrators, 16 tutors and 80 student-teachers/ Changu and Chako teachers' colleges, Tanzania.	Examined academic use of the internet and found that ICT accessibility is an impediment.
Zulu (2018), Augmenting Face-to-Face Learning with Information and Communication Technology at a Resource-Constrained Peri-Urban University Campus in Namibia. Africa Education Review pp 1-14	N/A	Mixed method/ 35 lecturers/ University of Namibia.	Studied the feasibility of integrating mobile technology applications in learning and the results indicate that psycho-sociocultural issues and resource constraints prohibit the mobile learning.
Shuter, Dutta, Cheong, Chen, and Shuter (2018), Digital Behaviour of University Students in India and the U.S.: Cultural Values and Communication Technologies in the Classroom. Western Journal of Communication Vol. 82, No. 2, pp. 160–180	N/A	Survey/ 920 college students and faculty members/ Asia and the United States.	Explored perceptions and behaviour of students within a digital classroom environment and found that attitude, culture and prohibitive policies influence students' behaviours.
Guzmán and Nyvang (2018), From Professors' barriers to organisational conditions in ICT integration in higher education. Læring & Medier (LOM) – nr. 18, 1-27	Cultural-historical activity theory (CHAT)	Qualitative/ focus group of professors/ National University (UNA), Costa Rica.	Investigated the organisational constraints of ICT adoption and integration in teaching and the results indicate that Institutional rules and the community hinder ICT adoption.
Salem and Mohammadzadeh (2018), A Study on the Integration of ICT by EFL Teachers in Libya. EURASIA Journal of Mathematics, Science and Technology Education, 2018, 14(7), 2787-2801.	N/A	Survey / 32 teachers/ Faculty of Art and Education/ University of Tripoli in Libya.	Explored the conditions for integrating ICTs in teaching and conclude that in availability is a of ICT infrastructure, shortage of computer skills and resistance to technology.

Barclay, Donalds, and Barclay (2018), Investigating critical success factors in online learning environments in higher education systems in the Caribbean, Information Technology for Development, 24:3, 582-611.	Extended Technology Acceptance Model	Survey/ 110 students/ university in Jamaica.	Examined the challenges faced by learners and instructors in adopting and effectively using eLearning. Results identified cultural practices, accessibility, availability, self-efficacy, usefulness and ease of use as factors influencing adoption and use of eLearning systems.
Nyahodza and Higgs (2017), Towards bridging the digital divide in post-apartheid South Africa: a case of a historically disadvantaged university in Cape Town, South African Journal of Library & Information Science 83(1)	Critical Theory	Mixed/ 6 librarians and 40 Masters' students/ University of Western Cape, South Africa.	Investigated the usage of library e-services and identified ICT accessibility, skills and language to be the key challenges in bridging the digital divide.
Isiyaku, Ayub, and AbdulKadir (2018), Antecedents to teachers' perceptions of the usefulness of ICTs for business education classroom instructions in Nigerian tertiary institutions. Asia Pacific Education Review (2018) 19:337–352	Technology Acceptance Model III.	Survey/ 212 teachers/ tertiary colleges, Nigeria.	Explored the antecedents of teaching with ICTs and conclude that teachers' computer self-efficacy and perceived enjoyment of ICTs significantly influence their perceived usefulness of ICTs.
Kanwar, Carr, Ortlieb, and Mohee (2018) Opportunities and challenges for campus-based universities in Africa to translate into dual-mode delivery, Distance Education, 39:2, 140-158,	Diffusion of Innovations	Survey/ 10 head of departments, 12 deans, 21 lecturers and 2 Ministry of higher education staff members/ Kenya, Rwanda and Cameroon respectively.	Assessed the barriers of engaging in an open distance learning based on ICTs and identified national policy, funding; infrastructure, organisational structure and capacity; complexity, cost of ODL; student and staff skills and attitudes to be hindering issues.
Vivakaran and Neelamalar (2018), Utilization of Social Media Platforms for Educational Purposes among the Faculty of Higher Education with Special Reference to Tamil Nadu, Higher Education for the Future 5(1) 4–19.	N/A	Survey/ 60 Faculty members of the universities and colleges/ Tamil Nadu, India.	Examined the barriers of the pedagogical use of social media platforms. External pressure (peer group and superior influence), task compatibility and students' attitude are the usage barriers.
Dube and Elsje (2017), A Survey of the University Students' Perspectives about Using Digital Technologies in Education: Zimbabwean Case, IAFOR Journal of Education, Volume 5 – Issue 1, 123-139.	N/A	Survey/ 100 undergraduate students/ University, Zimbabwe.	Studied students' perceptions about learning through digital technologies. Lecturers' resistance to technology has been implicated as a challenge.
Iqbal and Bhatti (2017) What drives m-learning? An empirical investigation of university student perceptions in Pakistan, Higher Education Research & Development, 36:4, 730-746.	Rational Analysis of Mobile	Survey/ 628 students/ 5 universities, Pakistan.	Explore the critical factors for m-learning adoption. The findings point o faculty support as a critical factor for m-learning.

	Education model.		
Li (2016), Are social media applications a facilitator or barrier to learning for tourism and hospitality management students? Research in Hospitality Management, 6:2, 195-202	Structuration Theory	Qualitative (focus group)/ 7 undergraduate students/ Chinese university.	Investigated the role of social media in learning and found that social media distracts learning.
Kgosiemang (2016), Information Literacy and Digital Divide: The Case of the University of Botswana Students Studying Part-Time, Education Reform Journal, 2016, 1(2), 56-70	N/A	Qualitative/ students and programme coordinators, University of Botswana.	Probed the factors leading to students' exclusion from participating in an ICT skills literacy programme. Results attribute this digital divide to ICT accessibility issues.
Parajuli (2016), Mobile Learning Practice in Higher Education in Nepal, Open Praxis, vol. 8 issue 1, pp. 41–54.	N/A	Mixed/ 161 undergraduate students/ Tribhuvan University, Nepal.	Explored the factors influencing the use of mobile technology for learning and results attribute low uptake to lack of institutional support.
Govender and Chitanana (2016), Perceptions of Information and Communications Technology (ICT) for Instructional Delivery at a University: From Technophobic to Technologically Savvy, African Journal of Information Systems, Volume 8, Issue 2.	Actor Network Theory.	Qualitative/ lecturers and chairmen of departments, university administration, ICT directors and technicians/ university, Zimbabwe.	Explored the factors of e-Learning adoption by educators. The results indicate that e-Learning adoption and use is influenced by ICT availability, training and technical support.
Torres-Diaz and Duart (2015), Determinants of digital inequality in universities: the case of Ecuador, Journal of e-Learning and Knowledge Society, Vol. 11, n.3.	N/A	Survey (online)/ 4,697 students/ five universities, Ecuador	Analysed the factors of the internet for academic activities. Family income was found to be very influential in widening the use gap.
Tarus and Gichoya (2015), E-learning in Kenyan universities: preconditions for successful implementation, EJISDC (2015) 66, 4, 1-14.	N/A	Mixed/ 9 university management, 14 e-learning support staff, 125 lecturers and 377 students/ Kenyan universities.	Identified technological, organizational and pedagogical components.to be pre conditions for a successful e-Learning strategy.
Eyo (2014), Digital divide in the utilization of Information and Communication Technology (ICT) in counsellor education in Nigerian Universities, Africa Education Review, 11:2, 91-102	N/A	Survey/ 38 lecturers and 104 students/ 5 universities, Nigeria.	Investigated digital divide in the utilization of ICTs in HEIs and found status of the users to be the cause.
Chitanana (2014), The adoption of e-learning at Midlands State University: opportunities and challenges, The Dyke vol 3.2 pp 28-42.	N/A	Survey/ 80 lecturers/ Midlands State University, Zimbabwe.	Explored challenges that hinder the adoption of e-learning in education. Findings indicate constraining infrastructural development, support and pedagogical considerations for e-learning.

Zanamwe et al. (2013), Use of Social Networking Technologies in Higher Education in Zimbabwe: A learners' perspective, International Journal of Computer and Information Technology Volume 2 Issue 1.	N/A	Survey/ 124 students/ five universities, Zimbabwe.	Explored the usage of social networking technologies to learn, and results show that this initiative is hindered by the institutions' management.
Liebenberg, Chetty, and Prinsloo (2012), Student Access to and Skills in Using Technology in an Open and Distance Learning Context, The international Review of Research in Open and Distance Learning, 13(4), pp250-268.	N/A	Survey/ 22216 students and 476 paper-based/ University of South Africa (UNISA).	The study explored the digital divide at UNISA and found it to be caused by poor ICT accessibility and usability.
Mokiwa and Phasha (2013), Using ICT at an Open Distance Learning (ODL) institution in South Africa: The learning experiences of students with visual impairments, Africa Education Review, 9:sup1, S136-S151.	N/A	Qualitative (interviews)/ 5 students/ ODL institution/ South Africa.	Investigated the ICT experiences of the visually impaired students and found them to be challenged by content representation and inaccessibility, software incompatibility, inflexible pedagogical practices etc.
Oladokun and Aina (2011) ODL and the Impact of Digital Divide on Information Access in Botswana, The international Review in Open and Distance Learning Vol 12 No 6.	N/A	Survey/ 519 students / tertiary institutions/ Botswana.	Examines the ICT access and usage divide by distance learners, and the findings attribute it to the geographic location of the students.
Brown and Czerniewicz (2010), Debunking the 'digital native': beyond digital apartheid, towards digital democracy, Journal of Computer Assisted Learning (2010), 26, 357–369.	N/A	Mixed/ 513 university students/ South Africa.	Examined the students' access and use of computers and cell phones in learning. The findings are that familiarity and experience with ICTs influences the digital divide.

Appendix C: Continent GDP Averages

List by the International Monetary Fund (2021 estimate)[3]

Rank	Continent	GDP (US$million)	Year
	World	91,030	2021
1	Asia	34,390	2021
2	North America	24,880	2021
3	Europe	23,050	2021
4	South America	2,900	2021
5	Africa	2,490	2021
6	Oceania	1,690	2021
7	Antarctica	N/A*	N/A

Appendix D: Comparison of theories in reviewed literature

Comparison metrics	Application	Purpose	Scope	Application to digital divide research
Actor Network Theory	Science and technology studies	Interaction	Macro	Moderate
Critical Theory	Critical studies	Critiquing	Macro & Micro	Low
Cultural-Historical Activity Theory	Relationship studies	Interaction	Macro	Low
Diffusion of innovation (DOI)	Descriptive studies	Assimilation	Macro & Micro	High
Resource Appropriation Theory (RAT)	Explanatory studies	Acceptance	Macro	Moderate
Rational Analysis of Mobile Education Model.	Analysis studies	Analysing	Macro & Micro	Low
Structuration Theory (ST)	Explanatory studies	Interaction	Macro & Micro	High
Technology Acceptance Model (TAM)	Descriptive studies	Technology acceptance	Micro	Moderate

Appendix E: Sample Responses from Lecturers

INTERVIEW WITH LECTURER 1

Venue: Office AG 15 Date: 16-03-16 Time 14:30 hours Duration: 50 minutes

InterviewerL1:
Do you have a working computer allocated to you by NUST?

IntervieweeL1:
No, I do not have a working computer allocated to me because the one However, I have multiple laptops which I acquired myself.

InterviewerL1:
What is the main function that you use the computer for?

IntervieweeL1:
Basically, to achieve my objectives and responsibilities which includes preparing learning materials, setting examination question papers etc. related to teaching.

InterviewerL1:
Which ICTS do you mostly use in the teaching practice?

IntervieweeL1:
I use the basic office suite for preparing my lectures. For statistical courses I use R and Octave, Expert systems I use Jess and there are programming courses we use C++ compilers we use for teaching just like R which I use to teach statistical courses.

InterviewerL1:
Are these ICTs provided by NUST?

IntervieweeL1:
Personally, I am an open-source person, so I acquire the programs I need for teaching not through the institution but from the Internet.

InterviewerL1:
Do you have adequate ICTs for teaching?

IntervieweeL1:
It is very difficult for me to comment on that because we are in an environment that is resource constrained and expenditure on software in my opinion and from what is going around is not really an expenditure that is welcome. The process of acquiring software was very difficult and we were meant to go via ICTs and ICTs is other expenditure, so it was supposed to be part of the budget for the ICTs, so I had to drop mid-way.

InterviewerL1:

Do you integrate the institutional eLearning platforms in your teaching?

IntervieweeL1:

Yes, I use them especially Navision to manage the students mark etc. and I use Sakai mainly to distribute material not as something that could be used to explain a concL1. I still believe that in terms of explanation it is important for a lecturer to be present for a student because a student sometimes thinks they have understood when either they wouldn't have got the point right or sometimes they are not just being honest with themselves. So, I believe a lecturer must be there. So, in a way I believe in blending face-to-face with the ICT based teaching and if I were to put a ratio to the blending I would say 60% face-to-face and 40% ICT driven teaching.

InterviewerL1:

Were you consulted prior to the implementation of these eLearning platforms at NUST?

IntervieweeL1:

I was aware of the existence of Sakai it the very beginning it was introduced at the time when they were still deciding whether to use Sakai or Moodle I was part of the team that was doing the feasibility study and the possibility of doing it all. Of course, along the way when it became administrative they then took over, so I was aware even when the Pearson group came to present their alternative system I presented in that presentation as well, so I would say I was there from the beginning.

InterviewerL1:

In your opinion how do these eLearning platforms compare?

IntervieweeL1:

At that time when Sakai was being introduced, I was proponent for Moodle because of its low resource requirements, however NUST then decided to go for Sakai which uses tom cat as server and java in the background. At that time, I was trying to raise the idea that the performance of a PHP server as opposed to a java server, a PHP server has got a better response time therefore it will be more easily accessible over the Internet considering resource scarcity at NUST for example people may want to access it outside NUST I understand with Sakai it's a bit of a challenge its more accessible within the confines of NUST than outside.

InterviewerL1:

Do these eLearning platforms reflect your ICT for teaching priorities and contributions?

IntervieweeL1:

I wouldn't say my contributions were completely rejected may be 20% of my contribution were implemented but one idea we raised now was that it must be open source to limit the licensing fees and obviously the Pearson packages were dropped.

InterviewerL1:

What features of the eLearning platform do you use most?

IntervieweeL1:

In Sakai eLearning platform, I mostly use attachments and announcements. Beyond that I don't think there is much justice especially examination tests online platforms I think it's not right to the point. For example, I focus on technical courses and you would want a student to show their skill in a particular area and if you were to give an online test you are likely to give a multiple choice such that it's going to be able to grade passes and fails and by mere guessing if you give a multiple choice of five choices per question then a guessing student can make it without knowing anything. It does give a wrong reflection of the students' performance and these students won't be invigilated during their writing, its online they can logon from wherever they are and even someone else can do the test for them or seek help elsewhere, so you won't be assessing a student as such.

InterviewerL1:
Have you had any challenges in your interaction with these eLearning platforms?

IntervieweeL1:
No challenges at all with the Sakai platform itself but just the general challenges like the connectivity issues are due to resource scarcity but in terms of the system itself being limited I have never been faced with any problems. The system crushes because its java run, and tom cat has known problems of multiple connections it's not specific to sakai but it's the performance of the engine that runs behind the java driven web pages it does not perform well with concurrent multiple connections so that's when it starts missing links etc.

InterviewerL1:
Have you attended any training organized by NUST on how to integrate the feature of the eLearning platforms in teaching?

IntervieweeL1:
Personally, I did not go through a training I am not sure if a workshop was held. I did not attend any refresher courses and did not attend any workshops. By the way technical and usage issues are two different things. At usage level I was taught by a colleague from my department. However, for Navision there has been courses and we have attended courses for it but for online learning the ICT department could have sent a manual a soft copy on the email, but personally I did not attend any workshop.

InterviewerL1:
Are you aware of any policy that supports the use of ICTs in teaching at NUST?

IntervieweeL1:
Yes, I have seen the draft of an ICT policy, which is still work in progress.

InterviewerL1:
Does the management at NUST support or encourage the integration of ICTs in teaching?

IntervieweeL1:
The department tries to encourage us to integrate the ICTs in our teaching for instance now we are encouraged to assess students on attachment via ICT based methods like skype, which saves the university travelling and sustenance costs when physically visits to companies are made as well as saving the lecturers time wasted while away from campus.

However, at the institutional level, I wouldn't say they encourage the integration of ICTs in teaching given the challenges faced when requesting for ICT resources that can improve our teaching. More so there are no incentives or recognition accorded those who make a personal ICT initiative.

InterviewerL1:
As a lecturer do you think you have enough skills or are you passionate about integrating ICTs in your teaching?

IntervieweeL1:
I have the advanced ICT skills and I am very passionate about ICTs; however, I also believe the lecturer must impart the basic knowledge that is required in the field and the student must expand on that. but if you take the eLearning platform on its own at best the lecturer can upload a pdf document or record a video of himself and upload it, but it is not interactive.

InterviewerL1:
Given a choice which method of teaching would work better for you?

IntervieweeL1:
I would choose blending ICT based teaching methods and the f2f method with a higher percentage like 60% on the f2f method. Although eLearning is relevant and good. I differ when it is used as a major tool for instruction because then the burden of explanation or interpretation is laid on to the student instead of the lecturer. I can recommend it only as a complementary technique not as a replacement for the f2f method of teaching and learning.

InterviewerL1:
Any recommendations regarding the eLearning platforms in teaching?

IntervieweeL1:
Yes, when you use open-source material you take it as it is its flaws and strengths, and you live largely with it and I don’t think NUST would want to fix that. and by the way these are those are some of the points we had indicated at the very beginning. I When it was proposed at the beginning I was not the proponent of it because of that limitation.

Also, when you are in class the students may not understand and can ask and rephrase using other words or a different example and make sure you address students' concerns. you can also identify gestures and see if they understand. also, students right wrong notes and use shorthand and the things you are explaining they write a simplified version of what you are saying which is ambiguous so next time the student reads that it’s no longer precise. so, when I am teaching usually during explanation I go through randomly looking at the notes if they are writing them properly. especially when writing things like programming mere indenting implies a lot and if the student does not indent properly, miss a semi colon the program will give them an error and they will be frustrated and think the programming language is difficult.

Appendix F: Sample Interview Responses from Technicians

INTERVIEW WITH THE ELEARNING PLATFORM TECHNICIAN

Venue:	AVU LAB	Date:	05-05-17
Time:	15:30 hours	Duration:	75 minutes

Interviewer-Software Technician:
What ICT based systems are currently implemented for teaching and learning at NUST?

Technician-eLearning: for teaching and learning there is Sakai, Google Classroom which was introduced last year in 2016 and Moodle which is hosted by CCE.

Interviewer-Software Technician:
Which of these three ICT based system is used mostly in teaching and learning?

Technician-eLearning:
Its Sakai which is used mostly by both the teaching staff using it to create course content that is used by the students to learn.

Interviewer-Software Technician:
What is the current level of uptake of Sakai eLearning platform?

Technician-eLearning:
The level of uptake is currently less than 50% which is however an increase from the last time we met because there are new members to the sakai system. Unfortunately, I cannot say off hand as to which Faculty uses Sakai eLearning platform more than others.

Interviewer-Software Technician:
Which features of the Sakai eLearning platform are more popular with the teaching staff and the students?

Technician-eLearning:
The resource feature where they upload their teaching material which the students download. Then the assignment tool for the assignment creation and submission of assignments by students the test and quizzes tool those 3 are the mostly used.

Interviewer-Software Technician:
Have there been any challenges reported which relate to the effective use of the Sakai eLearning platform?

Technician-eLearning:
Yes, challenges exist all though some of them are not to do with the Sakai software but with the hardware that will be faulty like last week there were issues when lecturers were failing to create assignments due to the date that had gone back to 2011so it wasn't the problem of sakai but the hardware, that is the server that is hosting it. The other problem has to do with tests and quizzes whenever a certain number of users is exceeded like as they say more than twenty try

to take the test at the same time the Sakai software crushes but if it's less than that the students can take the test without any problems.

Interviewer-Software Technician:
What have you done as technicians to solve the problem?

Technician-eLearning:
We are working on solving the problem. The current sakai version that is running is 2.10 so we hope to upgrade to 2.11 to see if there are any improvements on it.

Interviewer-Software Technician:
Is there an accessible user manual for the Sakai eLearning platform?

Technician-eLearning:
Yes, we have soft copies of the user manual for the lecturers and another for the students so it's up to the users to take advantage of them.

Interviewer-Software Technician:
In addition to the user manuals, do your technical staff provide a platform for online help in case a user fails to understand what's on the user manual or is confronted by a problem that's not addressed on the user manual?

Technician-eLearning:
Currently there is no such facility for the online help for the Sakai eLearning platform.

Interviewer-Software Technician:
What have been the reasons provided by the lecturers for not using the implemented eLearning platforms?

Technician-eLearning:
The don't trust technology they say technology fails them and others have said those who are using it in some high offices one of them said its just resistance to change, they are not eager to use and take advantage of technology.

Interviewer-Software Technician:
What strategies have you put in place to motivate the increase it the uptake of these platforms which the university has heavily invested in?

Technician-eLearning:
Our user support and training section holds workshops, and, in those workshops, we try to motivate them to use the system.

Interviewer-Software Technician:
How frequent are the workshops may be per semester?

Technician-eLearning:
The frequency of training depends on the academics as ICTs the user support plans and then the next thing the academics say they are busy. So far, it's mostly one workshop last year we

did one in December.

Interviewer-Software Technician:
What is the attendance level of such workshops?

Technician-eLearning:
Attendance is poor the same faces that you saw in the previous session are the same faces that you always see so it’s like those who are interested in the tool are the ones who show up.

Interviewer-Software Technician:
Will they be aware of those scheduled trainings and workshops?

Technician-eLearning:
Oh yes, the academics will be very aware of the training because our user support and training section do send the invitations via Sisonke and I remember in December she did send a registration form asking them to choose a date when they are free because these sessions normally when they are done we do not impose a date we ask the academics to register for a date. Before we moved on to google it was just a memo and the email will be sent and they will tell you the days and the academics would call to book the day they would want to come. But now we are using google so a form is sent via Sisonke to register online, so last year we got some non-academics coming also because they were interested in the eLearning tool.

Interviewer-Software Technician:
Do you get support from the management for conducting the training and workshops?

Technician-eLearning:
The ICT management supports the workshop sessions they even request the user support and training section to conduct these workshops and evaluate the workshops. The university management also supports this eLearning initiative because during the meetings they always emphasize that everyone should integrate these systems in the teaching and learning process.

Interviewer-Software Technician:
Are there any financial resources required to run these workshops and if so who funds them??

Technician-eLearning:
Yes, there is always costs incurred during these workshops which are supposed to be covered by the ICTs department but now that the university is cutting on costs its now a challenge because the trainees always ask for refreshments during the training which awe are now failing to provide as a department. However, in the training conducted last year, the user support and training manager had to personally provide the funds for refreshments tea from their personal funds. I am not sure what will happen in future weather there will be any refreshments provided during the training and workshops.

Interviewer-Software Technician:
Can we therefore conclude that lecturers don’t attend these e workshops and trainings due to lack of refreshments?

Technician-eLearning:
No that’s not the reason for the attrition but that the lecturers always say they are busy during the time these workshops are conducted. Surprisingly there is never a time when these lecturers are free because during the semester the say they are busy teaching while at the end of the semester thy are busy marking. After marking they go on leave so yah it’s really a challenge.

Interviewer-Software Technician:
From your experience with the Sakai eLearning platform, does its specific hardware requirements?

Technician-eLearning:
Not at all Sakai eLearning platform is web based so all you need is a browser on your computing device and then you are ready to work on it.

Interviewer-Software Technician:
Is Sakai eLearning platform compatible with other systems currently implemented at NUST?

Technician-eLearning:
There is a link with some of them. For example, there are currently 2 active directories one for the teaching staff members and another for the students. Currently there is an only a link between Sakai eLearning platform and the students’ active directory such that student’s login into the Sakai eLearning platform using the same credentials that they use on any other NUST systems like the portal and the NUST WIFI so once these credentials are active, there is no need for creating another account on Sakai with different credentials. However, for the teaching staff members we must create accounts for them so that they can also set up their classes. With Navision there is currently no link with Sakai eLearning platform, but it is not there but it’s possible to create that link between the two.

Interviewer-Software Technician:
So, the creation of that link between Sakai eLearning platform and Navision is work-in progress or what because the sentiments from the lecturers is that currently Sakai eLearning platform increases their workload due to its disintegration from the compulsory Navision system used for capturing students’ marks.?

Technician-eLearning:
Navision is a system used to capture students marks while Sakai eLearning platform is a teaching and learning tool so those are 2 different systems, but they can be linked. The teaching tool instead of giving assignments and marking them manually so it’s the same with the manually approach where students write assignments on paper and the lecturer marks and records in both approaches the lecturer will still have to record the marks on the Navision system for student marks, but the advantage of Sakai is that the lecturer doesn’t have to carry students’ assignments around and those can be automatically marked by the Sakai tool for that purpose. However, their integration is a planned project for the future, as of when it will be implemented I am not sure.

Interviewer-Software Technician:

Another challenge raised by the lecturers whom I have been talking to is that it is difficult to create the open-ended questions in Sakai which the system can automatically mark. I don't know if that is correct?

Technician-eLearning:

It is very easy to create open-ended questions on Sakai, in the test/quizzes tool is a choice of creating open questions in the short essay form. However, it is true that the marking tool on Sakai eLearning platform cannot mark the open-ended questions because the intelligence of the system is limited in that area.

Interviewer-Software Technician:

Here at NUST whose responsibility is it to maintain these eLearning platforms?

Technician-eLearning:

Sakai is maintained by the software section, Moodle is a responsibility of the Centre for continuing education (CCE) and Google-Classroom is not and in-house learning platform, but an application provided by Google, so our administration is only responsible for ensuring that users have user accounts.

Interviewer-Software Technician:

Are the teaching staff members and students aware of the implementation of the availability of that Google-Classroom teaching and learning tool here at NUST?

Technician-eLearning:

The teaching academics are aware, an email was sent by the director last year to that effect and a workshop on how to embrace the Google-Classroom was conducted where a comparison of Sakai eLearning platform with Google-Classroom was emphasized and we were even encouraging the teaching staff members to try both platforms because each has its merits and demerits for example too can time your test on Sakai but in Google classroom that future is not available unless if you manually indicate the starting and ending time for the test by manually starting and ending it. The danger is that if you forget to stop it the students will not submit but continue to surf the Internet for the answers.

Interviewer-Software Technician:

What is the uptake of Google-Classroom so far since its implementation?

Technician-eLearning:

A few lecturers less than five have requested for the refresher course showing the intention to use the system.

Interviewer-Software Technician:

Do you orient the students on how to use these eLearning platforms?

Technician-eLearning:

When we are training the teaching staff, we also invite the Faculty technicians so that they can be part of the training and be able to assist both lecturers and students particularly since they are the ones who work closely with the students.

Interviewer-Software Technician:

What would you recommend be done to increase the uptake of the implemented eLearning platforms?

Technician-eLearning:

They should try the platforms out and if they have any preferred systems they should recommend to us and we will facilitate that they get access to their preferred platforms. Mind you we are a Science and Technology university, so we can have as many systems as possible that depending on the capacity to host them. These systems are available all the time they can use them even while away during their study leave. The systems are useful to the block students who have limited time on campus for physical interaction, but the eLearning platforms can be a source of learning content for them and the good thing is that material can be revisited, Although Sakai does not have a recording feature, the teaching staff members can use any other tools for recording their lectures and then upload them on Sakai eLearning platform.

Appendix G: Sample Interview Responses from Chairmen

INTERVIEW WITH CHAIRMAN 6

Venue: Chairmen's office		Date:	23-10-18
Time: 10:00 hours		Duration:	30 minutes

InterviewerC6:
How long have you been with NUST?

IntervieweeC6: 20 years

InterviewerC6:
Have you worked for another educational institution before?

IntervieweeC6:
Yes, I worked at the university of Zimbabwe before coming to NUST.

InterviewerC6:
How were you using ICTs to improve your duties?

IntervieweeC6:
Unfortunately, at that time ICTs were not yet common because I was at UZ from 1989 to 1994 before leaving for my PhD. After that I came to NUST. However, during the time I was at UZ I never interacted with my students via ICTS. The only thing I would do was to send an email, and about ¾ of the class did not have email addresses so they relied on their friends for content or communications sent via email.

InterviewerC6:
Were there any challenges (would you care to share three major challenges)

IntervieweeC6:
Yes, I had challenges with ICTs at that time because we did not have computers in our offices but there was somewhere where we would go as lecturers to access the computers and send the emails. At that time the Internet was not as good as it is now.

InterviewerC6:
Utilization of ICTs usually has its own challenges I will read the challenges and you highlight yes if you have had the problem here at NUST.

InterviewerC6:
Connectivity challenges (slow, or always down)

IntervieweeC6:
It's down or if you are lucky its Internet connectivity is always down here at NUST and if you are lucky its slow, there is no other better word to describe it. Unlike in my house I connect

just like that to everything, my children come, and friends come, and we all connect with no speed problems. But as it is I am just arriving in the office and I might not even connect.

InterviewerC6:
Lack of proper training (any recommendation on how this can be improved)

IntervieweeC6:
I think training comes with education, most of my ICT training came when I did my first Masters, Second Masters and with my PhD was even more because then I would use ICTs to do so many things. I did not sit down, and someone started teaching that this is how you use these ICTs the learning is automatic it comes as you move on with your profession as you train yourself in your profession.

ICTs does a lot of training they have even trained us on how to use some these teaching programs and they even train us on these simple training they do a lot of training they keep on doing such that sometimes you don’t go because you don’t have time, but they are always there.

InterviewerC6:
Lack of training personnel

IntervieweeC6:
The training personnel is always there to train us.

InterviewerC6:
No access to ICTs devices (laptop, desktop etc.)

IntervieweeC6:
Devices I have access to them, but the question is am I going to use them effectively for access for whatever I want through the Internet.

InterviewerC6:
Absence of ICTs equipment for use

IntervieweeC6:
NA

InterviewerC6:
Power challenges (ZESA, no backup generators)

IntervieweeC6:
Everybody experiences power challenges here when the generator comes they don’t give us this side its only at the bursars everyone else does not have I don’t know about those other white buildings that side. When the power is out I just pack up and go home because I know I will work better at home and because I don’t stay far from the university

InterviewerC6:
Lack of adequate infrastructure and skilled ICT personnel

IntervieweeC6:
Yes, like I said before ICT infrastructure is not adequate especially for our students.

InterviewerC6:
Reluctance to new technology

IntervieweeC6:
Not even I have young lecturers who are very technologically literate all of them. I have some who go on study leave part time they give lectures to their students while they are there and they just project and interact with their students because there are softwires that they use to do that you can imagine they are quite knowledgeable.

InterviewerC6:
Are there any other challenges that you experience and feel we omitted?

IntervieweeC6:
I think one thing that is very important is that as much as I am saying that we have gadgets the university should buy us I have lectured at the university of Manchester when you get there the first thing they give you is a laptop. These ones are our own personal laptops. When you get to the university of Manchester the very first day you get there they give you an office, a laptop brand new and everything you need.

If the laptop requires any repair, they don't repair except if it's something small then they help they are willing to assist.

InterviewerC6:
I will now delve into issues of Organizational dynamics, culture and structures of NUST. Do you feel these have an impact on effective use of ICTs?

IntervieweeC6: NA

InterviewerC6:
If yes what part do they play?

IntervieweeC6:
NA

InterviewerC6:
Do you feel management has a role to play in the effective use of ICTs?

IntervieweeC6:
Yes, the management has a big role to play regarding the use of ICTs at NUST.

InterviewerC6:
If yes what role are they playing?

IntervieweeC6:

It is the NUST management that should see to it that we have adequate ICTs for use in teaching, learning and research. They should buy us laptops give us ICT devices or gadgets that we want and stop telling us that there is no money.

InterviewerC6:
We are now focusing on Governance issue. Are you aware of any ICTs policy documents?

IntervieweeC6:
No, I am not aware of the IC policy.

InterviewerC6:
Do you feel ICTs resources are evenly distributed, is there currently any bias in allocation of resources? Do you feel others are being given inadequate resources?

IntervieweeC6:
I don't think ICTs are evenly distributed because I don't think everyone with laptops have bought for themselves but must have gotten them through university funds.

The ICT policy is there but I have not signed it because if you are not invited to sign don't sign it. I have read the document maybe I did not internalize everything because I was choosing.

InterviewerC6:
Do you feel you or your team is adequately skilled or possess adequate knowledge to use ICTs and What gaps do you feel need to be addressed?

IntervieweeC6:
Yes, we are adequately skilled in ICTs.

InterviewerC6:
Do you feel collaborations with private and other institutions can improve effective use of ICTs?

IntervieweeC6:
I think in the world of today ICT has a role in everything even in raising your own child they applicable to everyone.

InterviewerC6:
Do you have any recommendations?

IntervieweeC6:
They should buy us laptops.

Appendix H: Sample Discussion Guide for Students

SAMPLE FOCUS GROUP DISCUSSION WITH PART 4 BIOLOGY STUDENTS

Venue:	SBB base room	Date:	20-11-17
Time:	13:00 hours	Duration:	85 minutes

InterviewerFG4:
Do you have a computer lab dedicated to you?

IntervieweeFG4:
We Biology students do not have a dedicated computer lab, but we use the faculty computer lab which is used by nine departments with students from part one to the master's level using the same single computer lab.

The other issue its only one semester I am not sure about this semester if they are going to do it again where they had pushed the closing time to about 730pm towards the exams I think it was last semester when they managed to do that but all along the lab was closing at 4;30pm but then there are other students who actually start lectures at 4;30pm that's the only time probably from 4;30 to 8;30pm that they can actually access the computers so I think if they could manage a shift or just extending the closing times its understandably during the semester it's up to 4;30 and hopefully towards the examinations they are going to push the time but if it becomes a regular thing I think it would help a number of people .

InterviewerFG4:
Is there a policy regarding BYOD?

IntervieweeFG4:
Personally I am not aware of the BYOD policy but the only problem when you bring your own device when you are going out and the security people want to search our bags because they think we stole the mouse and the keyboard from the computer labs personally that's the only problem that I have faced when you don't even use and don't have an idea of what was going on in that computer lab and then they will be searching for the mice and the keyboards and the bags but when we come in they don't even search for those things at times the only thing they ask for or check at times not always is student ID. NA.

InterviewerFG4:
As students do you take advantage of the available mobile devices to engage in the learning activities?

IntervieweeFG4:
I don't know if it's a problem or it was already designated but I remember when we were in part one we had to come with our own computers because we were parallel students and then the con class would hold their computer lessons in the computer lab so us as parallel students having to carry our computers at night is also a challenge sometimes as we risk losing them to thieves.

InterviewerFG4:
Do you find WhatsApp to be an effective learning tool?

IntervieweeFG4:
of course, we have these WhatsApp groups that we have but that app will be more professional than the WhatsApp group because whatever information the lecturer wants to relay to the students that will be communicated via the mobile app and we see it that will be easier.

InterviewerFG4:
Do your lecturers integrate ICTs when teaching?

IntervieweeFG4:
for most of our lecturers they do use the projectors they come with projectors they come with their own laptops they connect and yah

InterviewerFG4:
Are your computer labs fully equipped with the ICT devices that you need as students?

IntervieweeFG4:
The faculty computer lab is not fully equipped so basically the challenge is the overcrowding in that computer lab since it is used by nine departments in the faculty. so we have instances where for you to be using the computer you have to be here early in the morning because if you come around 9am or you come around half nine you find the computer lab is you find the computer lab is already fully occupied for the whole day you know when someone gets in there they make sure they leave their things so that they spend the whole day in there and the other challenge also is that you come here you want to do your assignment and or whatever but there is no Internet connection in the computer lab or probably you are in there first and the computer lab gets to full capacity then they have these instances where they chase out people who do not have their student IDs in a bid to try and clear out the computer lab so that they free up spaces for other people who are outside who want to use the computers

InterviewerFG4:
When not on the university campus, are you able to access the NUST network and other learning and research services provided online?

IntervieweeFG4:
We can't access the learning resources when not on campus for example Sakai also is difficult to access with any other network which is not from NUST you try accessing it using a different WIFI network which is not from NUST is really a problem so it is better to have a mobile app that accommodates everyone so that you don't really need to login to the system for you to be getting information and notes you will just be getting the notifications on your phone and that will be easier. Under normal circumstances a lecturer doesn't have to come and tell you that I posted something on Sakai, but you just must see it from wherever you are even when there is a test instead of getting surprises about a test that you didn't know of.

InterviewerFG4:

What other challenges do you face when using the Sakai e-learning system which you think constrain the effective learning practice?

IntervieweeFG4:

Sakai eLearning platform is all problems Sakai especially everything is wrong with-it A lecturer comes a month later and says I posted an assignment on Sakai did you see it we have been trying too login into sakai for the whole month and we couldn't login to sakai and maybe the due date is tomorrow so what do we have to do with that, so I think sakai has to be improved

The other time we tried writing a test on sakai the whole group of conventional and parallel class we were supposed to be grouped in groups of 15 students and we were more than 70 of which the network was going up and down the other time its working and the other time it's not so it's not reliable. The other thing it's not user friendly, the first time I had to ask for help from someone who also did not know the interface is a bit complex or tricky at least if they could try to make it simpler because right now I still see things that I did in part one and part two they are no longer relevant right now at least if they try to archive old information so that at least I see things that are relevant for this semester that is one thing rather than having everything just being there and screen out yourself the courses that I am doing this semester that's a bit of work so they need to try and improve the platform that will be better.,

InterviewerFG4:

Do your lecturers encourage you to learn through ICTs?

IntervieweeFG4:

From the mere reaction of you using a phone in the class you can tell that you can't even approach that individual it's not even a matter that you would think twice to take to the next step. may be probably that's the reason that people google stuff even during the test but that's a different matter altogether Taking pictures or recording a lecturer teaching that's taboo that's taboo that is not allowed some of them consider it to be disrespectful maybe they think we will be on WhatsApp or something don't know.

InterviewerFG4:

What are your ICT priorities or preferences?

IntervieweeFG4:

But we would want to be able to record or take a screen shot of what is happening maybe when a lecturer mentions a funny word that you don't understand what it means. Like in some instances you just come to school because you have to be at school so at times you won't or half the time you won't even be listening to whatever the lecturer is saying to you so if you have an instance where you were able to record at least when you get home and you have time you can actually sit down and listen to whatever they were saying so I think it will be beneficial in a way

We want a situation whereby whether you inside the building or out there in the open you can still connect to the WIFI but currently you can't even connect while in this lab where there is a router there you have to be near the router or under it or just holding your phone up like ok work with me here and it's like you know and have to keep your WIFI spot.

When you come into the NUST gate your phone should tell you that there is NUST WIFI and should connect not that I must walk all the way to the router which sometimes won't be connecting.

InterviewerFG4:
How does Google-Classroom compare to Sakai e-learning platform?

IntervieweeFG4:
We have never used google classroom because for me I think it was because no one ever oriented us on it our lecturers just asked for our personal emails, but people never attempted it or never pushed because it's an issue of awareness, so they should make students aware of the things that they need to use.

InterviewerFG4:
As students where you trained on how to use these e-learning platforms that are currently implemented at NUST?

IntervieweeFG4:
We were never trained on how to use these e-learning platforms. For example, on Sakai LMS we have mainly used the resources like the notes that we receive from the lecturers, the notes, announcements submitting assignments and the online quizzes and tests. But we don't like sakai anymore we just leave it there we don't care about it anymore because the process of logging in is tedious. if it is improved you I will see that even the lecturers will opt for the sakai platform because the reason why they are opting to send us the notes via email is because they are trying to find a way around sakai because its giving issues every time so if they improve the platform it will be better for learning.

InterviewerFG4:
What happens during the orientation period, don't you learn about using the e-learning platforms?

IntervieweeFG4:
During orientation we get to know about each other, finding new friends and being told about the yearbook nothing about sakai, google classroom or even the faculty computer lab I discovered the computer lab on my own. it is by the library where we show the ere sources section and how to use the computers which are there

InterviewerFG4:
Are you aware of the existence of the institutional ICT policy?

IntervieweeFG4: NA

InterviewerFG4:
What is your comment regarding the conditions of using ICTs in learning here at NUST, are the conditions conducive?

IntervieweeFG4:

just one challenge that I have there are some lecturers who hold their lectures in that comp lab there I don't know if it's appropriate for lectures to be held in the comp lab like as we have said that all these nine departments need to use that lab for research and to post assignments and then you find that there is a lecture you come here at 8am you find there is a lecture already starting at 8am to 10 sometimes to 12 so I don't know if that's fare. when we were in part one we used to do computer lessons and we used to bring our own laptops, so I don't if that's appropriate to hold lessons in the computer lab.

InterviewerFG4:

Given a choice as students would prefer ICT based or f2f learning? l

IntervieweeFG4:

ICT based approach is good, but it is better to have a mobile app that accommodates everyone so that you don't really need to login to the system for you to be getting information and notes you will just be getting the notifications on your phone and that will be easier. Under normal circumstances a lecturer doesn't have to come and tell you that I posted something on sakai, but you just must see it from wherever you are even when there is a test instead of getting surprises about a test that you didn't know of.

InterviewerFG4:

From your observation, do you think NUST is ready or prepared for ICT based education?

IntervieweeFG4:

We are far from being ready for ICT based education because looking at it from an area point of view look at the design of this lab you will actually see that we have the outlets for cable Internet connection and had these outlets been working we wouldn't be crowding in the computer lab because some would bring in their machines and plug in to these LAN things you would be just be googling from here and there would be no need to be competing for the WIFI and the computer lab. If we have these ports working in this lab and those other labs that are upstairs, we wouldn't be complaining that we don't have Internet and more, so we should have just found this lab as a working system already when we came for part one, but it seems it has been work-in-progress for too long.

For project consultation we do the up down method because the lecturers don't use them. If they don't use them we also don't use them .You can actually count the number of lecturers who have used the sakai platform and one of them happens to be the chairman he doesn't have an option he just have to promote NUST stuff Right now for projects we incur a lot of expenses in printing only because for the lecturers to mark my chapters I have to print and send that to them to mark it they want it in hard copy yet we have platforms like sakai where they can mark and put comments and send it back to me then I correct probably I should have a hard copy for the final document rather than for everything. Even for assignments we are not applying the anti-plagiarism systems because we submit in hard copy so what we do is to just copy and paste and even include references which do not even exist because we just submit hard copies and there is no way of testing. If all those assignments I was writing were screened and done properly I could be a better student by now

InterviewerFG4:

Are there any other challenges faced when using ICTs at NUST?

IntervieweeFG4:
Security is a challenge people can come in and steal somebody else laptop and go out its very easy but I have been to other universities when you get in through the gate they take note of the machines that you have like you actually login I have one laptop I have one cell phone blab blab so that when you get out they take note because we have had cases where people have lost gadgets here on campus you know like someone you just find your machine gone your laptop and the security is there I think its proper for us to have those measures where they control and take note of the number of the machines and whatever the gadgets that are getting through the gate monitoring their movement in and out. so, we are sometimes scared to bring our own devices due to fear of losing them to thugs especially at night after school.

our faculty computer lab has machines with too many viruses low maintenance they don't maintain no antiviruses you just put USB, and everything will be gone you have your assignment you go there and can't get it back. The moment you put your flush and before you even upload your assignment it is converted into an application it's no longer a word document you try opening it is now an application and its giving you error messages. We have had instances and those actually happen a lot like frequently you know every time you are typing something from a computer in that lab you have to finish it there and then email it or change to a pdf format then you print it because the moment you try to take it from there to edit it on other machine you are losing everything.

InterviewerFG4:
Do you have adequate ICTs for your research and learning?

IntervieweeFG4:
we still have issues about the coverage of the network it's still primitive its poor you just must be on the right spot for you to be connected to the Internet and in a normal day you come around this time around lunch time everyone is there everyone is connected to the Internet you can't connect. The LAN cables and Internet points are just dead, just a design and a waste of time, considering that it's a lab they I think they should know that we hold most of our lectures in labs as science students.

InterviewerFG4:
Can you comment about the ICT situation at NUST library are there enough e-resources for research?

IntervieweeFG4:
It's more like that library there which is still under construction what are supposed to complain about because they know we need a library, and they know that students need to use a library but they are not doing anything and that library in town is too small our own department alone from year 1 to 4 can't even fit in that library and some students stay in Selbourne meaning they can't afford to be communising everyday so we need a library on campus.

During exams we can't even fit in that library you have to get there before 8am for you to get a place in that library because if you get there by half 8 there will be a queue to enter the library. on top of that we have WIFI which won't be working because everyone is trying to read and trying to catch up. Even when you go to the basement or even upstairs the WIFI won't be working around 11 or 12 you are just seated there it won't be working we really need an improvement on the WIFI section because it's a bit limited and the textbooks are old you can't find the stuff you need from those things, so we need the WIFI.

The e resources part of the library is small and the machines I think about seven of them so the resources are limited, and you are timed you are given a time period to use the machines and after that you can't extend into use them it's usually 1 hour or even 3o minutes depending on the traffic if there are too many people they will just give you 30 minutes during which you I will still be trying to connect.

Exam papers and marking guides for the current years after 2003 are not available online instead the lecturers ask us to photocopy hard copies.

InterviewerFG4:
Does the university environment or contextual conditions promote an effective usage of ICTs in education?

IntervieweeFG4:
The environment is not safe because several students have lost their personal machines and other belongings to thugs and apparently it seems like NUST is only worried about security within the boundaries of the campus I am not very sure about what measures they have to ensure the security for their students because recently I was talking into this other guy who were robbed by TCZ a few guys came in and took their laptops they actually had injuries because they had a fight with those thugs who took their laptops and phones and nothing was done those are the stories that you hear every day and with the rate that you hear them they end up not being alarming because you know it's something that happens and recently there was someone that was robbed by the gate during the day just like that yah during the day someone just come from somewhere and take your laptop and go we are not protected in any way from such scenarios we are just left to be responsible on our own of which if you try to make it a police case or whatever you know how long the process is you are a student you are supposed to be at school and for you to follow up such a case with the police it will require a lot of resources and time and just because you are a student you end up saying let it go I will just buy another one but those are the cases that happen frequently especially towards the exams because people will be coming to school during the night to read trying to cover for whatever time they will have lost so around this time towards the exams that's when we have most of these cases and the machine is where most of your stuff is your project all your notes everything basically if someone grabs your laptop and takes it away from they have taken away everything because we are now having more of our school work in the machine than in hard copy.

InterviewerFG4:
Do you have any recommendations?

IntervieweeFG4:
I think if they try probably to increase the number of computers or probably to have a computer lab for each department and especially if you are now in part four you really need help and you need the Internet any time almost every day so I think if we have computers that are dedicated probably for the final year students so that they can be using the computers for whatever they want to use that will be a good idea.

I think if we have a two way communication where our lecturers appreciate the ICT and the Internet and teach us that way it will be way better because we had a situation last semester we had a different guest lecturer who was teaching us in that different way and it was a bit difficult to adjust he had to movies and slides and we would watch movies it was pretty intriguing and you would notice that people would attend lectures like they would want to see what he has brought for us on that day so if our lecturers could appreciate the whole technology.

Appendix I: Application Letter for Ethics Clearance

Department of Information Systems

31 March 2015

To whom it may concern

I would like to invite your institution to participate in an academic research case study towards the reduction of digital technology use divide in Higher Education Institutions in Zimbabwe.

The aim of this study is to gain an understanding and insight into the differences between access to and use of digital technologies in teaching and learning at the **National University of Science and Technology** and to identify possible strategies for reducing gap for future consideration. Survey questionnaires will be distributed to both the educators and students in the Faculties of Applied Sciences and the Library and information Science at the institution. Face-to- face interviews will be conducted with the Faculty deans in the two departments, Chairpersons of all the departments within the two faculties, institution management and the ICT personnel responsible for both e0learning, website and the digital library system, which are documents to be analysed over the months of June and July 2015.

Your participation in this research is voluntary. All information will be treated in a confidential manner and used exclusively for the purpose of this study. No individual names will be recorded or published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reasons, in accordance with ethical research requirements.

The anonymous survey questionnaire will take approximately 20 minutes to complete and the one-on-one interviews will take approximately 10 minutes with each participant at the **National university of Science and Technology** premises in Bulawayo, Zimbabwe.

Would you kindly respond in writing **(either via email or in print)** to this request. This is one of the requirements in the Department of Information Systems at University of Cape Town.

Should you have any questions regarding this research, please feel free to contact me on +27 78964 9180 or email: Sibusisiwe.dube@nust.ac.zw or sibusisiwenkonkoni@gmail.com.

Thank you for your time and participation.

Sincerely,

Mrs. Sibusisiwe Dube
PhD Student
Department of Information Systems
University of Cape Town
Email: [illegible]

Prof Elsje Scott
Research Supervisor
Department of Information Systems
University of Cape Town
Email: [illegible]

Appendix J: Ethics Clearance Approval

REGISTRAR'S OFFICE

MEMORANDUM

FROM: Registrar

DATE: 7 May 2015

TO: Mrs Sibusisiwe Dube
Department of Computer Science

EXT: 2404

REQUEST FOR PERMISSION TO DO RESEARCH AT NUST: A CASE STUDY IN THE REDUCTION OF DIGITAL TECHNOLOGY USE DIVIDE IN HIGHER EDUCATION INSTITUTIONS IN ZIMBABWE

Reference is made to your Memorandum dated 31 March 2015 on the above matter.

We would like to inform you that we have granted you permission to do a research which intends to find out the differences between access to and use of digital technologies in teaching and learning at the National University of Science and Technology and identify possible strategies for reducing the gap for future consideration.

We would like to emphasize that all the information gathered should be for research purposes only and that confidentiality has to be exercised.

F MHLANGA

cc Librarian
Directors – Research and Innovation
Director - Information and Communication Technology
Human Resources Section

FM/sd

Appendix K: Ethics Clearance Application Form

UNIVERSITY OF CAPE TOWN

FACULTY OF COMMERCE

Igniting Knowledge and Opportunity

Commerce Faculty Ethics in Research Application Form

Any person planning to undertake research in the Faculty of Commerce at the University of Cape Town is required to complete this form **before collecting or analysing data**. If any of the questions below have been answered YES, and the applicant is NOT an Honours student, the form it should be submitted to the supervisor (where applicable) and from there for approval by the Faculty EIR committee: Ms Samantha Alexander (**samantha.alexander@uct.ac.za).**

It is assumed that the researcher has read the UCT Code for Research involving Human Subjects (Available at http://web.uct.ac.za/depts/educate/download/uctcodeforresearchinvolvinghumansubjects.pdf) in order to be able to answer the questions in this form.

Students must include a copy of the completed form with the dissertation/thesis when it is submitted for examination.

1. PROJECT DETAILS		
Project title: The paradox of a second order digital divide in higher education institutions: Case of a highly literate country.		
Principal Researcher/s: Sibusisiwe Dube	**Email address(es):**	sibusisiwenkonkoni@gmail om
Research Supervisor: Professor Elsje Scott	**Email address(es):**	elsje.scott@uct.ac.za
Co-researcher(s):	**Email address(es):**	
Department: Information Systems		

Brief description of the project:

The study investigates the inconsistencies between the use of the available institutional Information and Communication Technologies (ICT) in institutions of higher learning. The disparities in ICT use have resulted in a second order digital divide, a problem of concern to the researchers that requires scholarly attention. The causes of this paradox and the possible strategies for reducing it will inform the higher learning institution management and decision makers on the future ICT choices and implementation strategies such that benefits from the technological investment could be realized. Additionally, the current gap in the literature regarding this paradox in a highly literate environment could be filled for the benefit of the concerned digital divide researchers.

Data collection: (please select)

X Interviews XQuestionnaire ☐ Experiment XSecondary data XObservation

X Other (please specify): Document a ____

Have you attached a research proposal OR a literature review with research methodology? (please select) X Yes ■ No

2. PARTICIPANTS

2.1 Does the research discriminate against participation by individuals, or differentiate between participants, on the grounds of gender, race or ethnic group, age range, religion, income, handicap, illness or any similar classification?	YES	NO X
2.2 Does the research require the participation of socially or physically vulnerable people (children, aged, disabled, etc.) or legally restricted groups?	YES	NO X
2.3 Will you be able to secure the informed consent of all participants in the research? (In the case of children, will you be able to obtain the consent of their guardians or parents?)	YES X	NO
2.4 Will any confidential data be collected, or will identifiable records of individuals be kept?	YES	NO X
2.5 In reporting on this research is there any possibility that you will not be able to keep the identities of the individuals involved anonymous?	YES	NO X
2.6 Are there any foreseeable risks of physical, psychological or social harm to participants that might occur in the course of the research?	YES	NO X
2.7 Does the research include making payments or giving gifts to any participants?	YES	NO X

If you have answered **YES to any of these questions**, please describe how you plan to address these issues (append to form): By making the study subjects aware that participation is voluntary, and they are free to withdraw from participating if there is need to do so.

Affiliations of participants: (please select)

X Company employees ☐ Hospital employees ☐ General public ☐ Military staff ☐ Farm workers X Students ☐

X Other (please specify): HEIs and ICT management and decision makers.

Race / Ethnicity:

Are you asking a question about race/ethics in your questionnaire?

☐ Yes ☐ X No

Which race categories have been used? N/A

Have you included the option: "Prefer not to answer" as part of your race/ethics question?

Does your research involve the participation of or provision of services to communities?
If your answer is YES, please complete below:

3.1 Is the community expected to make decisions for, during or based on the research?	YES	NO X
3.2 At the end of the research will any economic or social process be terminated or left unsupported, or equipment or facilities used in the research be recovered from the participants or community?	YES	NO X
3.3 Will any service be provided at a level below the generally accepted standards?	YES	NO X

If you answered YES to any of these questions, please describe below how you plan to address these issues.

If your research is being conducted within a specific organisation, please state how organisational permission has been/will be obtained:

An application letter requesting permission to conduct a study at a certain university in Zimbabwe was sought. A response was sent to the researcher granting permission to collect data from the willing participants. See the attached response.

Have you attached the letter from the organisation granting permission? (please select)

☐ X Yes ☐No, but this **will be** obtained before commencing the research ☐ Not applicable

Are you making use of **UCT students** as respondents for your research? (please select) ☐ Yes ☐X No

If yes, have you contacted Executive Director: Student Affairs for permission? (please select) ☐ Yes ☐No

Was approval granted? (please select) ☐ Yes ☐No ☐Awaiting a response

Are you making use of **UCT staff** as respondents for your research? (please select) ☐ Yes ☐X

No If yes, have you contacted Executive Director: Human Resources for permission? (please select) ☐ Yes ☐No

Was approval granted? (please select) ☐ Yes ☐No ☐Awaiting a response

Contact Emails: Executive Director: Human Resources (**Miriam.Hoosain@uct.ac.za)**
Executive Director: Student Affairs (**Moonira.Khan@uct.ac.za)**

4. INFORMED CONSENT

What type of consent will be obtained from study participants?

. Oral Consent

. Written Consent

Anonymous survey questionnaire (covering letter required, no consent form needed)

Other (please specify)

How and where will consent/permission be recorded? voice recorder and first page of survey question.

Have you attached an informed consent form to your application? ☐ Yes ☐X No

5. SPONSORSHIP OF RESEARCH

If your research is sponsored, is there any potential for conflicts of interest? N/A If your answer is YES, please complete below.

4.1 Is there any existing or potential conflict of interest between a research sponsor, academic supervisor, other researchers or participants?	YES	NO X
4.2 Will information that reveals the identity of participants be supplied to a research sponsor, other than with the permission of the individuals?	YES	NO X
4.3 Does the proposed research potentially conflict with the research of any other individual or group within the University?	YES	NO X

If you have answered **YES** to any of these questions, please describe how you plan to address these issues (append t form)

6. RISK TO PARTICIPANTS

Does the proposed research pose any physical, psychological, social, legal, economic, or other risks to study participants you can foresee, both immediate and long range? **(please select)**

☐ Yes ☐ X No

If yes, answer the following questions:

1. Describe in detail the nature and extent of the risk and provide the rationale for the necessity of such risks.
2. Outline any alternative approaches that were or will be considered and why alternatives may not be feasible in the study.
3. Outline whether and why you feel that the value of information to be gained outweighs the risks

1.
2.
3.

I certify that I have read the Commerce Faculty Ethics in Research policy
(http://www.commerce.uct.ac.za/Pages/ComFac-Download s**)**

I hereby undertake to carry out my research in such a way that.

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University.
- the stated objective will be achieved, and the findings will have a high degree of validity.
- limitations and alternative interpretations will be considered.
- the findings could be subject to peer review and publicly available; and

- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

Signed by:

	Full name and signature	Date
Principal Researcher/Student:	**Sibusisiwe Dube** S Dube.	22/09/15

This application is approved by:

Supervisor	**Elsje Scott**	23 September 2015
HOD (or delegated nominee – for all Honours Projects):	**Kevin Johnston**	28/9/15
Chair: Faculty EIR Committee (only for postgraduate research at Master and PhD level)	Dr Elsamari Botha	19 November 2015

CHECKLIST	SELECT
A full copy of a research proposal or a literature review with methodology is attached in a separate file	X■
Interview schedules / cover letters / questionnaires / forms and other materials used in the study are attached in separate files	X■
Organisational consent letter / UCT student or staff approval letter	X■

On your cover letter to your questionnaire have you included the following?	NA
1. The following UCT Logo	■ ■
2. A sentence explaining the aim of the research.	■ X
3. Sentences of a similar nature to below must be included in the cover letter or consent form:	
This research has been approved by the Commerce Faculty Ethics in Research Committee.	■ X
Your participation in this research is voluntary. You can choose to withdraw from the research at any time.	
The questionnaire will take approximately X minutes to complete.	■ X
You will not be requested to supply any identifiable information, ensuring anonymity of your responses.	■
Due to the nature of the study, you will need to provide the researchers with some form of identifiable information however, all responses will be confidential and used for the purposes of this research only.	X ■
Should you have any questions regarding the research please feel free to contact the researcher (insert contact details).	X OR ■
4. Have you scanned in your signature for the last section of the form?	■ X■

Appendix L: Matrix Query of Variables

	Academic freedom	Attitude	Awareness	Interest	Resistance	Self-efficacy	Technophobia	Training	Ecosystem	Security	Electricity	E-resources	Viruses	Preferences
Adoption	No	No	No	No	No	Yes	No	No	No	No	No	No	No	Yes
Academic freedom	Yes	No	No	No	No	Yes	No	No	No	No	No	No	No	No
Attitude	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	No	No	Yes
Awareness	No	No	Yes	No	No	No	No	Yes	No	No	No	No	No	No
Interest	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes
Resistance	No	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	No
Self-efficacy	Yes	No	No	No	No	Yes	No	No	No	No	No	No	No	Yes
Technophobia	No	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	No
Training	No	No	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
Ecosystem	No	Yes	No	Yes	No	No	No	No	Yes	Yes	No	No	No	No
Security	No	Yes	No	Yes	No	No	No	No	Yes	Yes	No	No	No	No
electricity	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No
E-resources	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No
Viruses	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No
Preferences	No	Yes	No	Yes	No	Yes	No	No	No	No	No	No	No	Yes
Skills	No	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No
Flexibility	No	Yes	No	No	Yes	No	No	No	No	No	No	No	No	Yes
Purpose	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No
Loss of control	Yes	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No
Bureaucracy	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Leadership	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Consultation	No	No	No	No	No	No	No	No	No	No	No	No	No	No
E-readiness	No	No	No	No	No	No	No	No	No	No	Yes	No	No	Yes
Funding	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Champions	No	Yes	No	No	No	No	No	No	No	No	Yes	No	No	Yes
Standards	No	Yes	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
Planning	No	No	Yes	No	No	No	No	Yes	No	No	Yes	No	No	No
Trust	No	Yes	No	No	Yes	No	No	No	No	No	No	No	No	Yes
Workload	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Politics	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Compatibility	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Complexity	No	Yes	No	No	No	Yes	No	Yes	No	No	No	No	No	No

	Academic freedom	Attitude	Awareness	Interest	Resistance	Self-efficacy	Technophobia	Training	Ecosystem	Security	Electricity	E-resources	Viruses	Preferences
Credibility	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No
Design	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Flexibility	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Functionality	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Adavantage	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	No	Yes
Triability	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No
Usability	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No
Accessibility	No	Yes	No	No	No	No	No	No	No	No	Yes	No	No	Yes
Affordability	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No
Availability	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Beliefs	No	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No
Culture	Yes	Yes	No	Yes	No	Yes	No	No	Yes	Yes	No	No	No	Yes
Policy	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No

Skills	Flexibility	Purpose	Loss of control	Bureaucracy	Leadership	Consultation	E-readiness	Funding	Champions	Standards	Planning	Trust	Workload	Politics	Compatibility	Complexity
No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No
Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	No	Yes	No	No	No	Yes
No	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
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Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
No	Yes	No	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes
No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No
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No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
No	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	No	No	No	No	No
No	No	No	No	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No
No	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
No	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No
No	No	No	No	No	No	No	No	Yes	No	No	No	No	Yes	No	Yes	No
No	No	No	No	No	Yes	No	No	Yes	No	No	No	No	No	Yes	No	No
No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	No
Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes

Skills	Flexibility	Purpose	Loss of control	Bureaucracy	Leadership	Consultation	E-readiness	Funding	Champions	Standards	Planning	Trust	Workload	Politics	Compatibility	Complexity
No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No
No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No	No	Yes
No	Yes	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes
No	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes
No	Yes	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No
Yes	Yes	No	Yes	No	No	No	No	No	No	No	No	Yes	Yes	No	Yes	No
Yes	Yes	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No
Yes	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	No	No	No

Credibility	Design	Flexibility	Functionality	Adavantage	Triability	Usability	Accessibility	Affordability	Availability	Beliefs	Culture	Policy
No	No	No	No	No	No	No	No	No	No	No	No	No
Yes	No	No	No	Yes	No	Yes	No	No	No	No	Yes	No
No	No	No	No	Yes	Yes	No	Yes	No	No	Yes	Yes	No
No	No	No	No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No	No	Yes	No
No	No	No	No	No	No	No	No	No	No	Yes	No	No
No	No	No	No	No	No	No	No	No	No	Yes	Yes	No
No	No	No	No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No	No	No	Yes
No	No	No	No	No	No	No	No	No	No	No	Yes	No
No	No	No	No	No	No	No	No	No	No	No	Yes	No
No	No	No	No	No	No	No	Yes	No	No	No	No	No
No	No	No	No	Yes	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	Yes	No	No	No	No
No	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	No
No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No
Yes	No	No	No	Yes	No	Yes	No	No	No	No	No	No
Yes	No	No	No	Yes	No	Yes	No	No	No	Yes	No	No
No	No	No	No	No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No	No	No	No	No
No	No	No	No	Yes	No	No	No	No	No	No	No	No
No	No	No	Yes	Yes	No	No	No	No	No	No	No	Yes
No	No	No	No	No	No	No	Yes	Yes	No	No	No	No
No	No	No	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes
No	No	No	No	Yes	No	No	Yes	No	No	No	No	Yes
No	No	No	Yes	Yes	No	No	Yes	No	No	No	No	Yes
No	No	No	No	Yes	No	No	No	No	No	Yes	Yes	No
No	No	No	Yes	Yes	No	No	Yes	No	Yes	Yes	No	No
No	No	No	No	No	No	No	No	No	No	No	No	No
No	No	No	No	Yes	No	Yes	No	No	No	Yes	No	No
No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Credibility	Design	Flexibility	Functionality	Adavantage	Triability	Usability	Accessibility	Affordability	Availability	Beliefs	Culture	Policy
Yes	No	No	No	Yes	No	Yes	No	No	No	No	No	No
No	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No
No	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes
No	No	No	No	Yes	Yes	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No
No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No
No	No	No	Yes	No	No	No	Yes	Yes	Yes	No	No	No
No	No	No	Yes	No	No	No	Yes	Yes	Yes	No	No	No
No	No	No	No	Yes	No	No	No	No	No	Yes	Yes	No
No	No	No	No	No	No	No	No	No	No	Yes	Yes	No
No	No	No	No	Yes	No	No	No	No	No	No	No	Yes

Appendix M: Framework Matrix of Emergent Themes

	Resources	Leadership	Context	Perceptions
Chairmen	inadequate ICT infrastructure, outdated software,	lack of ICT skills, limited time,	electricity power cuts Limited backup power Poor and slow internet	Poor planning, little or no management support
Lecturers	Not allocated computer no access to gadgets, WI-FI, internet, no projectors survive on borrowing from other departments	Prefer blended method, 60% on f2f method. ICTs promote cheating, I am adequately skilled. some have ICT inertia. lecturers too traditional. Work overload	Resource constrained, environment. No budget for software. WI-FI congestion, classroom infrastructure supports traditional learning methods,	Software expenditure not welcome. bureaucracy, ICT not prioritised, no training, no lecturer involvement in ICT issues, Lack of leadership or championing of ICT integration in education.
Students	Inadequately equipped labs, in affordable ICTs slow or down internet, malfunctioning LAN cables and switch inaccessible resources small internet coverage	Lack of ICT appreciation Lack of awareness about institutional online platforms and policies, no training on how to use e-resources.	No labs, funding, library too small, environment is insecure, too much light in lecture rooms, inadequate lecture rooms, library wrongly located, not enough campus-based student accommodation.	No funding for ICTs repairs, maintenance, replacement, incomplete library inadequate lecture rooms, no software licences, no ICT training insufficient student rooms, no policies, ICT awareness
Technicians	Few ICT device, shared projectors and labs, unlicensed software, no power sockets	Lecturers have negative attitude to ICTs, are too rigid, technophobic, have ICT inertia.	Poorly conditioned labs, too large classes for labs weak WI-FI reception. Limited lab furniture	Unfair distribution of ICT resources, departments ICT needs not supported, no ICT policy, no training budget

Appendix N: eLearning Training Invitation Email

Gmail novuyo

Compose

Inbox 2,003

Starred

Snoozed

Sent

Drafts

Sibusisiwe +

JULU KHAMIS MONGU BILAL
when is the deadline for assignmen

E- learning Training

Event Timing: December 8 -9 2016, Dec
Event Address: AVU Lab
Contact us on Ext 2245 or 2304 or icts(

Name *

Email *

Faculty/Department *

Which day will you attend? *

- [ ] Thursday 8 December 2016
- [ ] Friday 9 December 2016
- [ ] Wednesday 14 December 2016

Appendix O: eLearning Training Invitation

Notice E-learning Training   Inbox ×

Ms. Novuyo N. T. Bobo <novuyo.bobo@nust.ac.zw>
to notices

Good day

There will be e-learning training on Tuesday(8/8/17) and Wednesda

On Tuesday we will be conducting training on Sakai and on Wednes
registration.

To register for the training please follow the link below:

https://docs.google.com/forms/d/e/1FAIpQLScyRsUt1V06i9A75n2Y

Please bring your laptop.

Regards,

Novuyo N. T. Bobo
ICT User Support and Training Manager
Information and Communication Technology Services

Appendix P: Google Docs Training Invitation

Dear All

Herewith the registration form with updated dates for Goog

Regards,

Google Docs Training

Event Timing: 26-27 March and 5 and 6 April 2018
Time : 8:30 to 12:30 on both days
Event Address: AVU Lab
Contact ICTS Training on novuyo.bobo@nust.ac.zw

Name *

Appendix Q: Training Needs Request

Compliments of the New year.

We are circulating a survey that will help us better understand your
honestly as possible.

Your individual responses will be considered confidential . Summary
not take more than 5 mins of your time .

Herewith the link for the survey :

[ICT Training Requirements]

Thank you for your cooperation.

--
--
Regards,

Novuyo N. T. Bobo
ICT User Support and Training Manager
Information and Communication Technology Services
National University of Science and Technology
P.O. Box AC 939
Ascot

Appendix R: Empirical Observation about Consultation

Consultation concerns

InterviewеeL10:
I was never consulted prior to the implementation of the institutional sakai eLearning,

IntervieweeL11:
. I was never consulted prior to the implementation of the institutional sakai LMS I was just told that there is that system for use in the teaching and learning practice,

IntervieweeL12:
I was never consulted prior to the implementation of the institutional sakai eLearning platform.

I am never involved in decision making in most cases they are imposed but the consultation is important.

IntervieweeL2:
. I was never consulted prior to the implementation of the institutional sakai LMS I was just told that there is that system for use in the teaching and learning practice

IntervieweeL4:
I was never consulted prior to the implementation of the institutional sakai LMS I was just told that there is that system for use in the teaching and learning practice, the consultation was there on the formation of the departmental system, so my ideas were incorporated in the system development and implementation.

IntervieweeL5:
There was no consultation prior to the implementation of sakai and I have not been happy with sakai because it limits us to doing what sakai is capable of

nterviewеeL9:
When Sakai was implemented at NUST I was not yet employed here, but I guess the same thing might happened that when Google-Classroom was being introduced I was never consulted neither was I trained I only saw the email that was talking about the availability of the google classroom

Appendix S: Sample of the Institutional Timetable

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
Draft Master Teaching Timetable
Semester 1
September 2019 - December 2019

Wednesday										
		8.00 - 9.00	9.00 - 10.00	10.15 -11-15	11.15 -12.15	1.00 - 2.00	2.00 - 3.00	3.15 - 4.15	4.15 - 5.15	5
C/HALL							CBU4109			
LLT	250	CAC2101	CAC2101	CBU1102	CBU1102	CIN1106	CIN1106	CFI2101	CFI2101	
SLT1	150	SMA1101	SMA 1101	SPH1104	SPH1104	SCS1101EN	SCS1101EN	PLC1101CIS	PLC 1101 CIS	
SLT2	150	TIE1103	TIE1103	TCW1101	TCW1101	CAC2104	CAC2104	SPH1101	SPH1101	
CEN 1	80	TCE2101	TCE2101	TCE2104	TCE2104	ILI2108	CIN 2103	CIN2103	CIN1108	
CEN 2	80	TCE3103	TCE3103	TCE3104	TCE3104			SMA4162P	PU1102	
CEN 3	80	TEE3133	TEE3133	CFI2102	CFI2102	SPH1105	SPH1105	SORS1201	SORS1201	
FW8C	40	SCI2103	SC2103	CIN2116		SCI2102	SCI2102	SORS4106	SORS4106	
FD3C	70	TIE2107	TIE2107	TIE2106	TIE2106	TIE2103	TIE2103	TIE2109	TIE2109	
FD4C	50	CIN4110	CIN4110	CIN4110	CIN4110	CIN4116	CIN4116	CIN 4111		
FD8C	80	FOBE								
FD11C	80	CBA1004ES	CBA1004ES	IRA2107	IRA2107	ILI 1103	TXT4236	TXT4236		
FD16 C	50	TEE5141	TEE5141	TEE2115	TEE2115	SCI4104	SCI4104	SMA1112	SMA1112	
FD32C	80							CIN1108	CIN1108	
FD33C	80	FIT								
FD39CNCHEI	80	TCE1102	TCE1102	CBU2103				TCE1103	TCE1103	
SD14C CHEM	50	TCE5104	TCE5104	TCE5103	TCE5103	TCE5116	TCE5116			
SD16C ELEC	50	TEE2113	TEE2113	TEE5111	TEE5111	SCI4104	SCI4104			
SD 17C	50	FOBE								
GD 23		INSURANCI								
FD1	30	SPH2105	SPH2105	ILI 4106	CBU2105	IRA2108	IRA2108	ILI1110		
FD2	30	CIN2119	CIN2119	IJM2112	IJM2112	CIN2120	CIN2120			
FD3	30	CIN2110	CIN2110		CBU2104	IRA4103	IPU1114	IPU1114	IPU1114	
FD4	30	IJM1115	IJM1115	SSC2112	SSC2112	SSC2101	SSC2101	IPU2113	IPU2113	
GDROOM		FOBE								
FD44	30	CBU4106	CBU4106	TXT4236	TT4236	IJM4113	IJM4113	IRA1104	IRA1104	
FD45	30	IRA2107	IRA2104	SRA2107	SRA2107	SMA 1103	SMA 1103	IJM4113	IJM4113	
FD46	30	SSC2103	SSC2103	SSC4114	SSC4114	CIN2111	CIN2111	SSC4115	SSC4115	
FD47	15	LANGUAGE AND PUBLISHING COMPUTER LABORATORY								
SD2	35	SRA4102	SRA4102	IRA4101	IRA4101	TXT2103	TXT2103	IRA4102		
SD7	30	ILI 2110	ILI 2110	ILI 2110	ILI 2104	IJM2116	IJM2116	SPH2101	SPH2101	
SD8	35	IJM4112	IJM4112	IJM4112	IJM4112	IJM2111	IJM2111	IJM2111	IJM2111	
SD67	35	ILI 1109	ILI 1109	IJM1111	IJM1111	IPU4101	IPU4101	IPU4101		

Appendix T: Departmental Timetable

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
Department of Computer Science
FINAL Conventional Teaching Timetable - Semester I
August 2019 to December 2019

										F
Monday		8.00 - 9.00	9.00 - 10.00	10.15 -11.15	11.15 - 12.15	1.00 - 2.00	2.00 - 3.00	3.15 - 4.15	4.15 - 5.15	S
SLT1	150	SCS 1211/1212	scs 1211/1212							S
FD4C	50									S
GW14								SORS1201/SC	SORS1201/SCI	S
FD16C	50									S
SD71	30									C
G41/PART 2	80	SCS2101/SCI	SCS2101/SCI	SCS2104	SCS2104	SCS2108	SCS2108			F
FD55	30	SCI 1203	SCI 1203							S
FD56/MSc				SC12102	SCI2102					S
FD60/PART 1 LAB		SCI4101	SCI4101	SCI4105	SCI4105	SCI4102	SCI4102	SCI4104	SCI4104	S
FD99/ PART 4 LAB		SCS4110	SCS4110	SCS4111	SCS4111					S
Tuesday		8.00 - 9.00	9.00 - 10.00	10.15 -11-15	11.15 - 12.15	1.00 - 2.00	2.00 - 3.00	3.15 - 4.15	4.15 - 5.15	S
SLT1	150	SCS1206/SCI/SM/	SCS1206/SCI/SM	SCS 1200(FAS)	SCS 1200(FAS)					S
GW 14	80							SORS1201/SC	SORS1201/SCI	S
FW8C	50									S
HALL1	70			SCS1207/SCI/S	SCS1207/SCI/SORS					C
FD11C										F
G41/PART 2	80	SCS2101/SCI	SCS2101/SCI	SCS2102	SCS2102	SCS1204	SCS1204			S
CELAB										S
FD55	30	SCI 1203	SCI 1203			SCI1202	SCI1202	SCS1205	SCS1205	S
FD56/MSc LAB				SCI2106	SCI2106	SCI2101	SCI2101	SCI2103	SCI203	S
FD60/PART 1 LAB		SCI4103	SCI4103			SCI4105	SCI4105	SCI4101	SCI4101	S
FD99/ PART 4 LAB		SCS4101	SCS4101	SCS4103	SCS4103	SCS4108	SCS4108			S
FIT LAB										F
Wednesday		8.00 - 9.00	9.00 - 10.00	10.15 -11-15	11.15 -12.15	1.00 - 2.00	2.00 - 3.00	3.15 - 4.15	4.15 - 5.15	S
SLT1	150					scs1211/1212	scs1211/1212			S
GW14	80	SORS2104/SCS	SORS2104/SCS					SORS1201/SC	SORS1201/SCI	S
FW8C	40									S
SD16C ELEC	50									S
SD 17C	50									S
G41/PART 2	80	SCS1202	SCS1202	SCS2104	SCS2104	SCS2102	SCS2102			
FD55	55			SCI1202	SCI1202			SCI2104	SCI2104	F
FD56/MSc LAB						SCI2103	SCI2103			S
FD60/PART 1 LAB						SCI4104	SCI4104			S
FD99/ PART 4 LAB		SCS4108	SCS4108	SCS4111	SCS4111	SCS4103	SCS4103	SCS2108	SCS2108	S
Thursday		8.00 - 9.00	9.00 - 10.00	10.15 -11-15	11.15 - 12.15	1.00 - 2.00	2.00 - 3.00	3.15 - 4.15	4.15 - 5.15	S
C/HALL								SCS1207	SCS1207	S
SLT1	150					SCS1206/ENG	SCS1206/ENG			S
FW 8 C	40									F

Appendix U: NUST ICT Policy Document

NUST ICT ACCEPTABLE USE POLICY AND PROCEDURES

Approved July 2018

Table of Contents

ICTS Department

Page

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

ICT ACCEPTABLE USE POLICY AND PROCEDURES

1 BACKGROUND

This document constitutes a university-wide policy intended to allow for the proper use of all National University of Science and Technology (NUST) computing and network resources, effective protection of individual users, equitable access, and proper management of those resources. This document should be broadly interpreted. This policy applies to users of the NUST network and any other NUST ICT resources. These guidelines are intended to supplement, not replace, all existing laws, regulations, agreements, and contracts that currently apply to computing and networking services at NUST and Zimbabwe.

The policy is designed in compliance with the National ICT policy.

The policy seeks to protect and apply safe and best practices.

Campus units that operate their own computers or networks are encouraged to add, with the approval of the unit head, individual guidelines that supplement, but do not lessen the intent of this policy. In such cases, the unit will inform users and provide a copy of the unit-level policy to the office of communication upon implementation.

Access to the NUST Network is a privilege, not a right. Access to networks and computer systems owned or operated by NUST requires certain user responsibilities and obligations and is subject to University policies and local and international laws. Appropriate use should always be legal and ethical. Users should reflect academic honesty, mirror community standards, and show consideration and restraint in the consumption of shared resources. Users should also demonstrate respect for intellectual property; ownership of data; system security mechanisms; and individual rights to privacy and to freedom from intimidation, harassment, and annoyance. Appropriate use of computing and networking resources includes instruction; independent study; authorized research; independent research; communications; and official work of NUST units, recognized student and campus organizations, and agencies of the University.

2 POLICY STATEMENT

2.1 Information & Communication Technology (ICT) is provided to support the teaching, learning, research and administrative activities of the University. The data held on the network forms part of its critical assets and is subject to security breaches that may compromise confidential information and expose the University to losses and other legal risks.

2.2 University guidelines and policies change from time to time; therefore, users are encouraged to refer to online versions of this and other University policies on the University website.

2.3 Any infringement of these regulations may be subject to penalties under civil or criminal law, and as such law may be invoked by the University. Any infringement of these regulations constitutes a disciplinary offence under the University procedures and may be treated as such regardless of legal proceedings. Abuse of the regulations may result in the user's account(s) being suspended.

2.4 These regulations are periodically reviewed by the ICT Senate Committee for the University Senate.

3 PURPOSE

3.1 This policy has been established to:

3.1.1 Provide guidelines for the conditions of acceptance and the appropriate use of the computing and networking resources provided for the use by academic, professional and support staff and students at the University in support of the mission of the University.

3.1.2 Provide mechanisms for responding to external complaints about actual or perceived abuses originating from the University network and computer systems.

3.1.3 To provide the mechanism for responding to internal complaints about actual or perceived abuses against University systems from the internet.

3.1.4 Protect the privacy and integrity of data stored on the University network.

3.1.5 Mitigate the risks and losses from security threats to computer and network resources such as virus attacks and compromises of network systems.

3.1.6 Reduce interruptions and ensure a high availability of an efficient network essential for sustaining the businesses of the University.

3.1.7 Encourage users to understand their own responsibility for protecting the University network.

3.1.8 To ensure compliance without limitation to statutes and regulatory.

4 AUDIENCE

4.1 This policy applies to:

4.1.1 Authorized users (academic, professional, support staff, students and others to whom access privileges have been extended) using either personal or University provided equipment connected locally or remotely to the network of the university.

4.1.2 All ICT equipment connected (locally or remotely) to University servers.

4.1.3 ICT Systems owned by and/or administered by the ICTS department of the University.

4.1.4 All devices connected to the University network irrespective of ownership.

4.1.5 Connections made to external networks through the University network.

4.1.6 All external entities that have an executed contractual agreement with the University.

5 INDIVIDUAL PRIVILEGES

I) The following individual privileges, all of which currently exist at NUST, empower all members of the NUST community to be able to work towards fulfilment of the NUST vision and objectives. It must be understood that these privileges are conditioned upon acceptance of the accompanying responsibilities within the guidelines of the ICT Acceptable Use and Procedures Policy.

ii External users should note that NUST Internet access is not for free. For external users attending conferences or functions at NUST, the cost for ICT resources access should be incorporated in fees for hiring and accessing the venue.

5.1 Privacy

To the greatest extent possible in a public setting, NUST seeks to preserve individual privacy. Electronic and other technological methods must not be used to infringe upon privacy.

However, NUST computer systems and networks are public and subject to the NUST.

ICT Acceptable Use Policy and Procedures usage Policy. All content residing on University systems is subject to inspection, and any such inspection should be carried out in the presence of the user. If the user is not available other means may be used as in Section 11.

5.2 Ownership

5.2.1 The electronic resources of the University are to be used for academic, research, consultancy or other business purposes in serving the interests of the University and its students, staff and clients and in the course of normal operations.

5.2.2 Intellectual property works created using NUST ICT resources will belong to NUST unless declared with the NUST intellectual property office in conjunction with ICTS.

5.2.3 Any ICT or electronic communications address, site, number, account or other identifier associated with the University, or assigned by the University to individuals, units or functions of the University, is the property of the University.

5.2.4 Electronic communications records pertaining to the business of the University are considered University records whether or not the University owns the electronic communications facilities, systems or services used to create, send, forward, reply to, transmit, store, hold, copy, download, display, view, read, print or otherwise record.

6 RESPONSIBILITIES

6.1 Council

Council has ultimate responsibility for information security within the University. More specifically, it is responsible for ensuring that the University complies with relevant external requirements, including legislation.

6.2 Senate

Senate or any future equivalent body is responsible to Council for:

a. Responsibility to source and make available resources,

b. Funding for the Senate ICT sub-committee and ICTS to implement,

c. Have oversight of policy and make available resources for the implementation of the policy.

6.3 Senate ICT sub-committee (SICT)

The Senate ICT sub-committee (SICT), or any future equivalent body, is responsible to Council.

for:

I. ensuring that users are aware of this and all other policies relating to the use of ICT resources at NUST.
II. seeking adequate resources for its implementation.
III. monitoring compliance of this and other policies.
IV. conducting regular reviews of the policy, having regard to any relevant changes in legislation, organisational policies and contractual obligations; and
V. ensuring there is clear direction and visible management support for security initiatives.

6.4 Vice Chancellor

a. Vice Chancellor as Chief Executive Officer for the institution is responsible for the overall information security within the whole University .
b. Overseer for the Senate ICT sub-committee and ICTS as a department to implement policy as well as avail resources for the implementation of the policy.
c. Pro-Vice Chancellors in the Vice-Chancellor's office are responsible for the operational planning and coordination of ICT policies implementation.

d. Through the ICTS Department in the Vice-Chancellor's office enforce all relevant policies and regulations to ensure information security

6.5 Deans / Directors

Given the University's devolved structure, Deans are responsible for information security within their faculties. They must ensure that the faculty has in place a local information security policy to meet its own particular needs, consistent with the requirements of this overarching policy.

6.6 Heads of Departments/ Sections

Given the University's devolved structure, heads of department are responsible for information security within their departments. They must ensure that the department has in place a local information security policy to meet its own particular needs, consistent with the requirements of this overarching policy. The local information security policy should identify the department's own information security requirements and provide a management framework for meeting those requirements. 'Department' in this context includes equivalent local units, as well as divisional offices.

6.6.1 Specific roles and responsibilities for information security within departments should be clearly identified.

6.6.2 The head of department must approve the policy, and ensure that it is disseminated , implemented and regularly reviewed.

6.7 Users and External Parties

Users of University information will be made aware of their own individual responsibilities for complying with University and departmental policies on acceptable use. Agreements with third parties involving accessing, processing, communicating or managing the University's information, or information systems, should cover all relevant security requirements, and be covered in contractual arrangements.

6.8 User Responsibilities

6.8.1 The user of a University computer account or computer system connected to the University is responsible for the actions associated with the computer account or computer system.

6.8.2 Users must ensure that they use all reasonable means to protect their equipment and (if applicable) their account details and passwords.

6.8.3 Engaging in any prohibited activities referred to in section 8 of the University Acceptable Use Policy and procedures may result in disciplinary action being taken.

6.8.4 Users are expected to assist ICT support staff with investigations into suspected violations or breaches of security ~~.~~

7 Acceptable Use and Personal Use

7.1 ACCEPTABLE USE

7.1.1 The University provides electronic communication systems and services to departments and faculties in support of its academic mission. ICTS encourages their use and makes them widely available to the University community. Nonetheless, the use of these facilities constitutes acceptance of this policy and is subject to the following limitations, necessary for the reliable operation of the electronic communication systems and services.

7.1.2 Users must comply with all applicable laws.

7.1.3 The electronic resources should be used for the purpose for which they are intended.

7.1.4 Users must respect the rights, privacy and property of others. Users are prohibited from looking at, copying, altering or destroying anyone else's personal files without explicit permission (unless authorized or required to do so by law or regulation)

7.1.5 Users must adhere to the confidentiality rules governing the use of passwords and accounts, details of which must not be shared.

7.1.6 Passwords must not be disclosed to anyone even if the recipient is a member of ICTS. Temporary passwords provided by ICTS staff to users must be changed immediately following a successful login.

7.1.7 Whilst the University network is being used to access other networks, any abuses against such networks will be regarded as an unacceptable use of the University network.

7.2 Personal Use:

Users of the NUST ICTS resources are allowed to use the resources for personal use subject to the following guidelines:

7.2.1 The University network and computing resources may be used for incidental purposes provided that:

7.2.2 The purposes are of a private nature, not for financial gain and does not contravene any other staff policies.

7.2.3 Such use does not cause noticeable or unavoidable cost to the University.

7.2.4 Such use does not inappropriately interfere with the official business of the University.

7.2.5 Such use does not include any actions defined in Section 8 of the University ICT Acceptable Use Policy and Procedures.

8 UNACCEPTABLE USE

8.1 The University ICT facilities must not be provided to individual consumers or organizations outside the University except where such services support the mission of the University or are in commercial interest of the University and permission has been granted by ICTS.

8.2 The University adopts a policy of cooperation with copyright holders and law enforcement bodies and may suspend or remove content published online while investigating claims from such bodies.

8.3 The University will from time-to-time act to suspend or remove content from websites which will jeopardize the University's reputation or brand.

8.4 Any misuse of the University network resources may be seen as a breach of University disciplinary and lead to disciplinary action.

8.5 The University network may not be used for the following activities:

8.5.1. The creation, dissemination, storage and display of obscene or pornographic material.

8.5.2. The creation, dissemination, storage and display of indecent images of children.

8.5.3. The creation, dissemination, storage and display of hate literature.

8.5.4. The creation, dissemination, storage and display of material that promote terrorism.

8.5.5. The creation, dissemination, storage and display of defamatory materials or materials likely to cause offence to others.

8.5.6. The downloading, storage and dissemination of copyright materials including software and all forms of electronic data without the permission of the holder of the copyright or under the terms of the licenses held by the University.

8.5.7. Any activities which do not conform to applicable laws and other University guidelines and policies regarding the protection of intellectual property and data. Specific emphasis is placed on the downloading and copying of both music and video files through the internet using peer-to-peer file sharing utilities such as but not limited to Limewire, Morpheus, Bit Torrent etc.

8.5.8. The deliberate interference with or gaining illegal access to user accounts and data including viewing, modifying, destroying or corrupting data belonging to other users.

8.5.9. Using the network or centrally managed services for commercial work for outside bodies without explicit permission from the Director of ICTS.

8.5.10. Use of a username and password belonging to another user.

8.5.11. Attempts to crack capture passwords or decode encrypted data.

8.5.12. Intentional or reckless creation, execution, forwarding or introduction of any viruses, worms, Trojans or software code designed to damage, self-replicate or hinder the performance of the University network.

8.5.13. Deliberate actions that might reduce the effectiveness of any antivirus or other ICT security management precautions installed by authorized University staff.

8.5.14. Attempts to penetrate security measures (hacking) whether or not this results in a corruption or loss of data.

8.5.15. Purposefully scanning internal or external machines in an attempt to discover or exploit known computer software or network vulnerabilities.

8.5.16. Engaging in commercial activities that are not under the auspices of the University.

8.5.17. Using computing resources (CPU, time, disk space, and bandwidth) in such a way that it causes excessive strain on the computer systems or disrupts denies or creates problem for other users.

8.5.18. Connecting any computer device to the University network unless it meets the desktop security standards established by ICTS on behalf of the University.

8.5.19. Any other use that may bring the name of the University into disrepute or expose the University to the risk of litigation.

9 PASSWORD POLICY

9.1 Introduction

Passwords are the primary authentication method for the University ICT resources. The combination of unique usernames and passwords ensure that only authorized individuals have access to specific information resources and ensure accountability for all changes made to system resources.

Strong passwords promote a secure computing environment.

Users must be diligent in guarding against internal and external threats to University resources by adopting strong passwords and by not sharing them under any circumstances.

Users must not respond to emails or phone calls asking them to provide their username and password. Under no circumstances will the University or one of its agents require a user to disclose their password.

9.2 Requirements for all users

9.2.1. Passwords must be kept confidential and under no circumstances be shared.

9.2.2. The requirements for the setting of the password vary from time to time depending on the best industry practice. The following is an exemplary but not exhaustive list of the criteria that can be used for setting passwords: Username or variations of the username should not form part of the password.

- Passwords must not be blank.

- Passwords must contain alphanumeric characters.
- Passwords must contain special characters.
- Password length must not be less than 8 characters.
- Password cannot be reused.
- Passwords cannot be substantial parts of a previously used password.

9.2.3. Passwords must not be written down.

9.2.4. Passwords must not be stored on digital media.

9.2.5. Passwords must be changed periodically at intervals no longer than 3 months for staff and twelve months for students.

9.2.6. Passwords must be changed immediately if there is suspicion that the password confidentiality might have been compromised.

10 E-MAIL POLICY

10.1 Introduction

This Electronic mail (e-mail) security policy's purpose is to ensure that all e-mail.

correspondence conducted by employees of NUST, either internally or externally, is proper and in good conduct. To this end there are a few responsibilities, compliance and privacy issues that each user of the e-mail system has to adhere to.

This policy sets out the general rules for the use of NUST's e-mail systems, including electronic.

noticeboards hosted thereon, together with specific protocols and guidance concerning the Data Protection implications. E-mail and other electronic information systems will, in accordance with the university's Information Strategy, reduce the need for paper-based communication. The Institute makes available e-mail systems for use by its staff and students and encourages the appropriate use of e-mail as an alternative to paper-based communication.

The university's e-mail systems are coordinated and managed by Information and Communication

Technology Services. No other email systems (servers or clients) are recognised or supported within the University.

10.2 Privacy, Confidentiality and Public Records Considerations

NUST will make reasonable efforts to maintain the integrity and effective operation of its

electronic mail systems, but users are advised that those systems should in no way be regarded as a secure medium for the communication of sensitive or confidential information. Because of the nature and technology of electronic communication, the University can assure neither the privacy of an individual user's use of the University's electronic mail resources nor the confidentiality of particular messages that may be created, transmitted, received, or stored thereby.

All Official Outgoing Emails should contain user signatures and the signature MUST include the names and surname of sender, post held, NUST address and phone numbers and the sender contact numbers. The university will append all outgoing email with a disclaimer shown in Section 18.3.3 of the Appendix.

10.3 Permissible Uses of Electronic Mail

The use of any University resources for electronic mail must be related to University business, including academic pursuits. Incidental and occasional personal use of electronic mail may occur when such use does not generate a direct cost for the University. Any such incidental and occasional use of University electronic mail resources for personal purposes is subject to the provisions of this policy.

10.4 Prohibited Uses of Electronic Mail

Other prohibited uses of electronic mail include, but are not limited to:

10.4.1. Personal use that creates a direct cost for the University is prohibited.

10.4.2. The University's electronic mail resources shall not be used for personal monetary gain or for commercial purposes that are not directly related to University business.

10.4.3. Sending copies of documents in violation of copyright laws

10.4.4. Capture and "opening" of electronic mail except as required in order for authorized employees to diagnose and correct delivery problems.

10.4.5. Use of electronic mail to harass or intimidate others or to

interfere with the ability of others to conduct University business.

10.4.6. Use of electronic mail systems for any purpose restricted or prohibited by laws or regulations of Zimbabwe and the University.

10.4.7. Spoofing i.e., constructing an electronic mail communication so it appears to be from someone else.

10.4.8. Snooping i.e., obtaining access to the files or electronic mail of others for the purpose of satisfying idle curiosity, with no substantial University business purpose.

10.4.9. Attempting unauthorized access to electronic mail or attempting to breach any security measures on any electronic mail system or attempting to intercept any electronic mail transmissions without proper authorization.

10.4.10. Use of Electronic mail in creation or distribution of any offensive, or disruptive messages, including messages containing offensive comments about race, gender, age, sexual orientation, pornography, religious or political beliefs, national origin or disability.

10.5 Cautionary notes

The nature of e-mail is such that total confidentiality cannot be guaranteed, and users should be.

aware of the following points about the use of e-mail:

10.5.1. Copies of e-mail may exist on a back-up copy or a remote system even after the author or recipient has deleted the message.

10.5.2. E-mail may be forwarded by any recipient without the author's consent, although it may not have been the author's intention. A forwarded message may be a modified version of the original.

10.5.3. It is possible for the author or sender of e-mail to disguise or alter them identity

10.5.4. Organizations outside the University may have different policies on e-mail. Some consider it the property of the organization, subject to examination, copying or forwarding. Be aware of this possibility when sending e-mail.

10.5.5 A reply to a personal message sent via a 'listserver' or electronic bulletin board may be inadvertently distributed to all subscribers to the list.

10.5.6 Usernames and passwords should not be disclosed to others. This could result in security breaches and other people using your e-mail account to send unauthorized messages. Suspected security breaches should be reported to ICTS at once.

10.5.7 Once a message is sent, there is no way to retrieve it. Check carefully that messages are addressed to the correct recipient(s) before sending.

11 Auditing

11.1 ICTS will endeavour to maintain privacy of e-mail. However, there may be special cases where it is essential that e-mail messages are accessed due to, for example, illness of the owner of a mailbox. In these instances, on the request of a Dean of Faculty or Head of Service and on the authorisation of the Head of ICT (or appropriate deputy), ICT may locate and make available e-mail messages for access by a nominated member of staff. The owner of the mailbox will be notified in due course.

11.2 Certain authorised members of ICTS may necessarily have access to the contents of e-mail messages in the course of system administration. Any knowledge thus obtained will not be communicated to others, unless required for system administration.

11.3 ICT reserves the right to take special actions in administering e-mail if this is essential to preserve the integrity or functionality of the systems. This may include the deletion of e-mail.

12 Retention

The University has an automatic centralised system to archive e-mails. This enables the University to track down previous e-mails in respect of correspondence that would be significant in an internal or external matter (e.g., correspondence of a contractual nature).

It will also be used to provide access to information by the government of Zimbabwe.

The e-mails are simply to be stored as part of an archiving system.

The Institute may use personal data contained within e-mails for particular purposes when its purpose is set out or clearly implied by the nature of the e-mails. E-mails will be archived for a period of one year.

13 Deletion and Archiving

E-mail messages are archived along with other files in accordance with existing ICTS operational procedures so messages deleted by the user may still be held on archives. However, archiving of e-mail messages is not guaranteed so users should make their own copies of essential messages.

14 Email Monitoring

The University will not monitor electronic mail as a routine matter, but it may do so to the extent permitted by law, as the University deems necessary for purposes of maintaining the integrity and effective operation of the University's electronic mail systems.

15 Security - Opening and Closing of Accounts

Computer and e-mail accounts for staff are set up by ICTS on receipt of a request from Personnel. Associated passwords are issued directly to the end user or via Faculty administration. Staff accounts are deleted on receipt of a request from Personnel. Student accounts are created automatically after enrolment of the student and remain active until the end of the course or receipt by ICTS of notification of withdrawal. Student passwords are issued in accordance with the current procedures.

Before leaving employment at NUST, staff should unsubscribe from any e-mail lists that they may have subscribed to and delete any personal e-mails in their account. If there are any work-related e-mails that need to be transferred to another email client then these e-mails should be forwarded on as appropriate - the ICTS department can be e-mailed if any assistance is required.

Following the departure of a member of staff from the University, their e-mail account will be closed and an "out of office" message set for a period of 12 weeks after which time the account will be deleted. NUST management may request access to be given to the closed mailbox by another member of staff for this duration.

16 Inspection and Disclosure of Communications

The University reserves the right to inspect and disclose the contents of electronic mail:

- in the course of an investigation triggered by indications of misconduct or misuse,
- as needed to protect health and safety,
- as needed to prevent interference with the academic mission, or
- as needed to locate substantive information required for University business that is not more readily available by some other means.

The University will inspect and disclose the contents of electronic mail when such action is necessary to respond to legal processes and to fulfil the University's obligations to third parties.

17 Compliance

Appropriate disciplinary action will be taken against individuals found to have engaged in prohibited use of the University's electronic mail resources. If any need arises to waiver policy communication should be done to the ICTS director.

Acknowledgement

NUST will take any violations of this e-mail policy or related policies like the Information Security Policy very seriously. NUST reserves the right to discipline, terminate or prosecute any user who violates any of these mentioned policies.

18 APPENDIX

18.1 DEFINITIONS

Authorized use-Authorized use of NUST-owned or operated computing and network resources is use consistent with the education, research, and service mission of the University, and consistent with this policy.

Authorized users-Authorized users are:

(1) Current Academic and Non-Academic staff, Registered Students and Current University Council members

(2) Individuals connecting to a public information service; and

(3) Others whose access furthers the mission of the University and whose usage does not interfere with other authorized users' access to resources. In addition, all users must be specifically authorized to use a particular computing or network resource by the campus unit responsible for operating the resource.

(4) External users whose registration fees or prior arrangements have been authorised for the specific duration indicated.

18.2 General Email guidelines

18.2.1 Check your e-mails regularly.

18.2.2 Employees are expected to answer email within 8 working hours of receiving an email.

18.2.3 Emails, which have cc recipients, should be replied in the same manner. i.e., The replier should also put the original cc recipient as a cc recipient in the reply.

18.2.4 Use of the bcc field: Use of bcc is encouraged if you are sending mail to a group of people where others may not want their addresses publicised. This is to protect privacy of other people's email addresses.

18.2.5 Be polite. Messages sent by e-mail can often seem abrupt, even when this is not the intention. Use professional courtesy and discretion. The use of all upper-case text in either the subject or the body of an e-mail should also be avoided as this is deemed to be the e-mail equivalent of shouting.

18.2.6 Do not reply "With History" if it is not necessary especially if it incorporates a large attachment.

18.2.7 Use 'reply all' and distribution lists with caution in order to keep the number of your messages to a minimum and reduce the risk of sending messages to the wrong people.

18.2.8 Set the Out-of-Office flag and arrange for someone to deal with your e-mail if you are away.

18.2.9 Messages should be clearly addressed to those from whom an action or response is expected, "cc" or "bcc" should be used for other recipients of the message.

18.2.10 Respect privacy and consider this aspect before forwarding messages.

18.2.11 Delete unwanted or unnecessary e-mail. It is the user's responsibility to manage their own e-mail folders and keep within the quota limits set. ICTS can give advice and assistance if required.

18.2.12 Unsolicited e-mail, especially with an attachment, may contain a virus. If in doubt, delete the e-mail or contact the sender to check before opening.

18.2.13 Do not try to carry out confidential or sensitive tasks or air controversial views on e-mail.

18.2.14 Enter a meaningful 'subject' field to help the reader anticipate the content correctly and try to keep to one subject per message.

18.2.15 Don't use all or part of someone else's message without acknowledgement.

18.2.16 Don't edit someone else's message without making it clear the changes that you have made and don't distribute other people's messages without permission.

18.2.17 Avoid subscribing to unnecessary mailing lists. Unsubscribe from mailing. Lists when they are no longer required.

18.2.18 Do not forward on e-mail "chain letters". These are e-mails which either ask you to forward them on to all your friends (or to everyone you know) or which state that something bad will happen if you do not forward them on. E-mails of this type, which are warning about something (e.g., computer viruses), are almost certainly hoaxes as well. If you are unsure about any e-mail that you've received then students can contact Computer Laboratory staff for information and staff can e-mail the ICTS staff.

18.3 Substantive Rules

18.3.1 Users are advised never to open mail especially containing attachments from unknown sources.

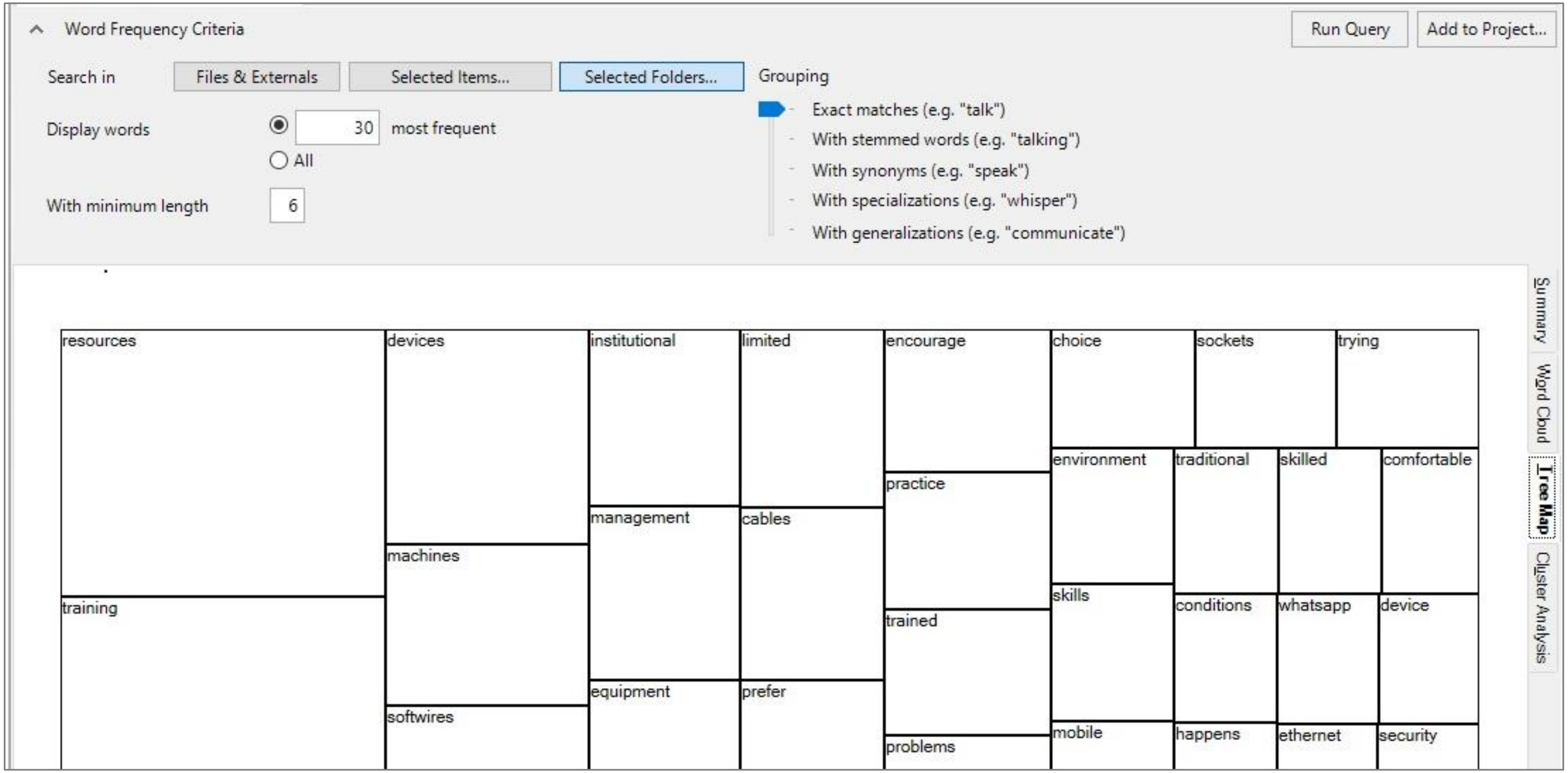
18.3.2 The following mail attachment extensions will not be allowed .exe .rar .pif. scr. The email server will block any mail outgoing or incoming containing such attachments and the administrators might add more file extensions to the list as deemed fit.

18.3.3 In addition all messages will be appended with the following disclaimer: *'This message is intended only for the named recipient . If you are notified that disclosing ,*

copying, distributing or taking any action in reliance on the contents of this information is strictly prohibited. This email is confidential , may be legally privileged, and is for the intended recipient only . If an addressing or transmission error has misdirected this email please notify the author by replying to this email. If you are not the intended recipient you must not use , disclose, distribute, copy, print or rely on this email. Any views or opinions presented are solely those of the author and do not necessarily represent those of the National University of Science and Technology. The National University of Science and Technology, Zimbabwe, does not accept legal responsibility for the contents of this message. Whilst all reasonable steps are taken to ensure the accuracy and integrity of information and data transmitted electronically and to preserve the confidentiality thereof, no liability or responsibility whatsoever is accepted if information or data is, for whatever reason, corrupted or does not reach its intended destination. Replies to this email may be monitored by the National University of Science and Technology, Zimbabwe for operational, security or business reasons.

18.3.4 Any user of the University's electronic mail resources who makes use of an encryption device to restrict or inhibit access to his or her electronic mail must provide access to such encrypted communications when requested to do so under appropriate University authority.

Appendix V: The Word Frequency Query Search Criteria

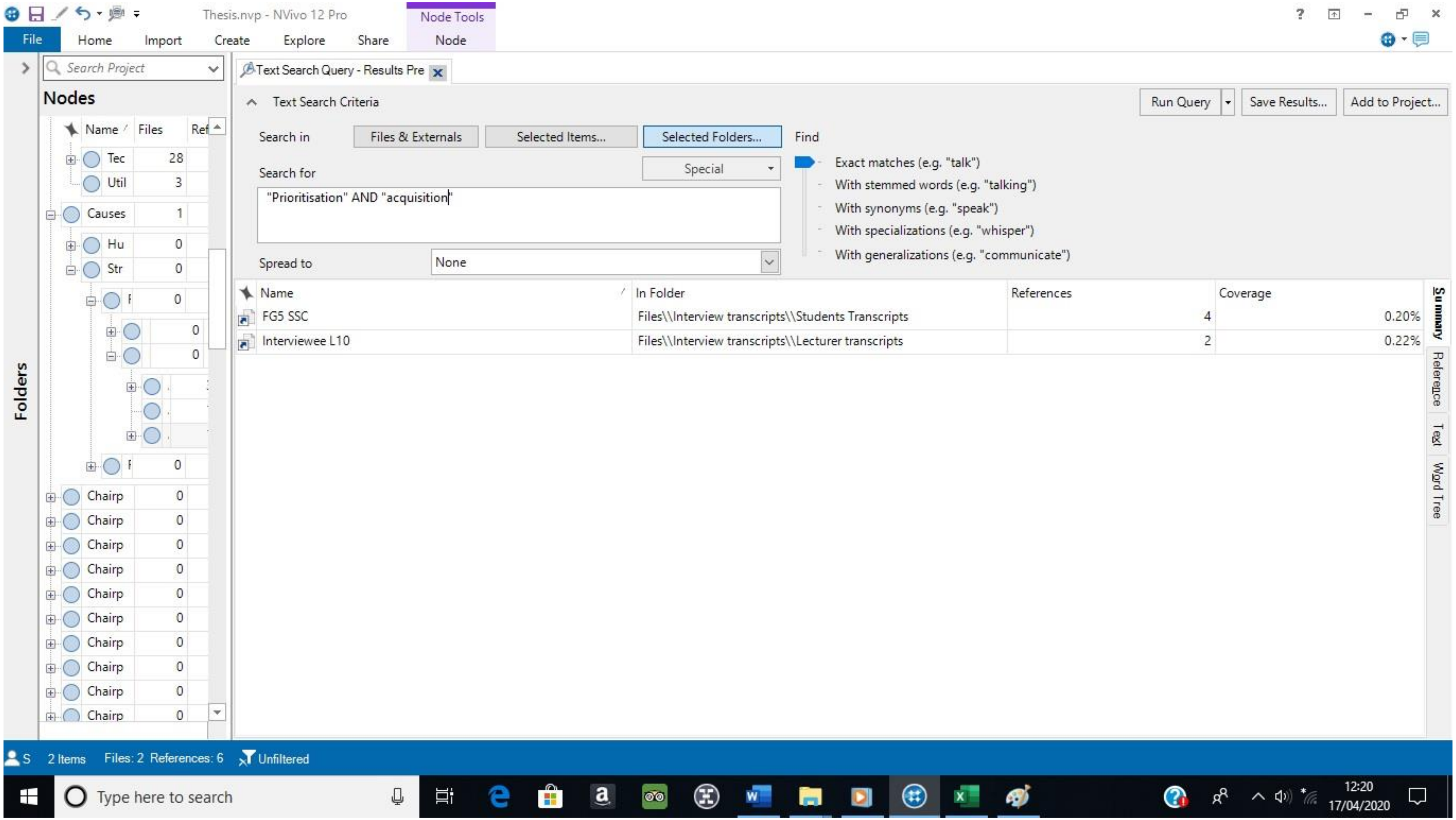


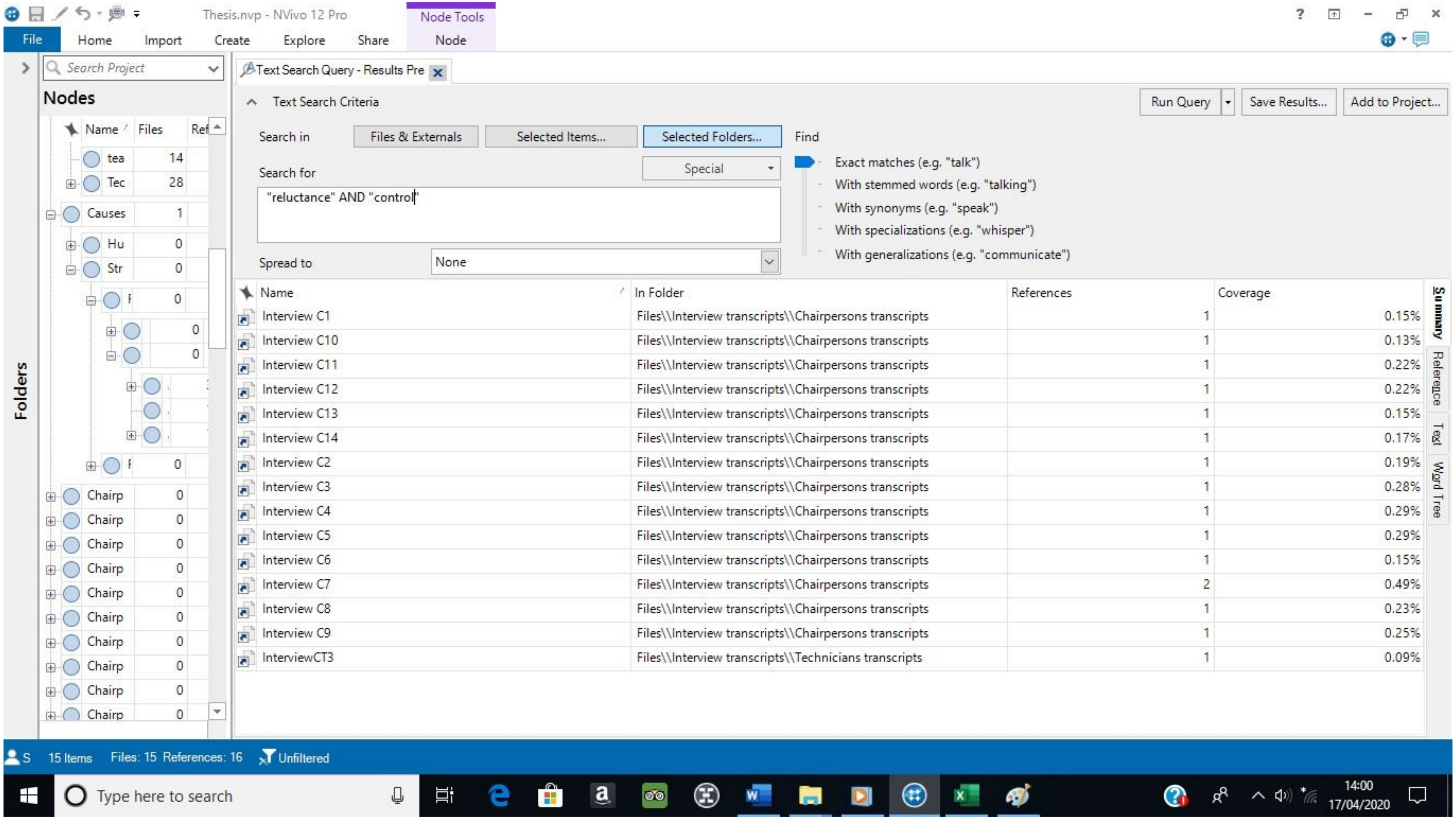
Appendix W: Popular Words in the Empirical Data

Word	Length	Count	Weighted Percentage (%)	Similar Words
leadership	6	701	0.81	acquiring, acting, administration, adoption, allocation, appropriation, assessment, assist, assistance, assume, attention, choice, collaboration, communicating, compromise, contribution, creation, decision, delivery, development, favour, impact, influence, leadership, maintenance, management, motivating, motivation, payment, politics, recommend, representative, responsibility, sharing, solving, standardization, sustenance, training
behaviour	10	690	0.83	accept, acknowledge, acting, active, activities, assist, assistance, attention, attrition, behaviour, booking, capture, change, comfort, complement, contribution, creation, development, digging, disintegration, distraction, freeze, freezing, hunting, interest, inventory, limitation, manual, practice, resistance, resort, sponsorship, struggle, sustenance, timing, training, utilisation, utilization, voicing, workload, advantage, alternative, choice, choosing, favorable, favour, opting, option, orient, oriented, prefer, preferably, preferences,
resources	9	563	1.43	adapter, assets, battery, device, devices, display, engine, facility, filter, generator, inventory, keyboard, locker, mahines, monitor, printer, radius, recording, resource, resourced, resources, router, security, surface, switch, softwires.
empowerment	8	469	0.85	accomplish, acquire, checked, conditioning, conditions, developed, development, direct, directed, literacy, master, manual, practice, prepared, preparing, precise, proficient, schooled, skilled, skills, technical, technique, trained, training, trainings, trains.
moving	6	403	0.51	assume, bother, capture, chance, change, combine, commit, congregate, correct, decision, depart, device, direct, display, distribute, disturbance, download, exchange, filter, follow, following, forward, handle, impact, impose, improvise, indent, install, interfere, locate, manage, manipulate, middle, mobile, motivate, motivating, motivation, movement, moving, orient, practice, presume, proceeding, progress, prompted, pursue, recognise, reduce, register, repair, resist, resort, respond, revisit, rotate, rushing, separate, signal, single, sitting, spread, standing, stream, strive, struggle, suggest, surface, switch, touched, transit, travel, travelling, upload, walking
practice	8	367	0.66	applied, applying, commit, despite, feasibility, follow, manual, normal, patterns, possible, practically, practice, proficient, pursue, skilled, skills, training, virtual
events	6	331	0.67	acquiring, acting, administration, allocation, appropriation, assessment, assist, assistance, assumption, attendance, behaviour, capture, catching, causing, change, choice, collaboration, communicating, compromise, corrections, creation, dealing, delivery, events, exchange, fighting, finding, gathering, hitting, hunting, important, influence, integrating, interaction, justice, leadership, location, management, market, medium, motivating, motivation, notification, option, payment, politics, practice, proceeding, production, pulling, pushing, rating, resistance, responsibility, rolling, search, sending, sharing, spotting, standardization, struggle,

change	6	316	0.39	acquire, adjust, affect, alleviate, appreciate, assist, assume, attrition, beginning, blending, bottleneck, bringing, change, changed, changes, changing, clarification, colour, combine, comfort, concentrate, conclude, converted, correct, creation, customise, cutting, delivery, development, discharge, disturbance, duplicate, dynamic, enable, exchange, expand, following, formation, freeze, fusion, graduate, happening, impact, implement, improvement, incorporate, initiative, innovation, installing, investment, lessen, lighting, market, marking, mixture, mobile, movement, orient, overload, parallel, perfect, phenomenon, pollution, progress, receive, recommend, reduce, repair, replacement, retail, revamp, rotate, rushing, separate, sitting, spotting, standing, stream, substantiate, switch, switches, tighten, travel, travelling, troubleshoot, unfreeze, upgrade, utilize, variety, visualize, walking, weather
knowledgeable	13	235	0.33	attention, attitude, complement, creativity, deciding, devices, difficulty, excuse, favour, history, influence, informed, innovation, instance, knowing, knowledgeable, language, leadership, literacy, movement, normal, perspective, practice, replacement, [illegible]
support	8	226	0.32	accept, adoption, assist, assistance, assistants, assisting, attend, backup, colour, demonstrate, dependent, device, embrace, encourage, encouraging, ensure, excuse, frequent, friendly, friends, funded, funding, hanging, helpful, holding, influence, maintenance, promote, proponent, radius, resource, second, secretary, sponsored, sponsorship, standing, stomachs, subscribed, [illegible]

Appendix X: The Criteria and Results for Word Searches




Thesis.nvp - NVivo 12 Pro
Node Tools
File
Home
Import
Create
Explore
Share
Node
Search Project
Nodes
Text Search Query - Results Pre
Text Search Criteria
Run Query
Save Results...
Add to Project...
Search in
Files & Externals
Selected Items...
Selected Folders...
Find
Exact matches (e.g. "talk")
With stemmed words (e.g. "talking")
With synonyms (e.g. "speak")
With specializations (e.g. "whisper")
With generalizations (e.g. "communicate")
Search for
Special
"reluctance" AND "control"
Spread to
None
Name
In Folder
References
Coverage
Interview C1 Files\\Interview transcripts\\Chairpersons transcripts 1 0.15%
Interview C10 Files\\Interview transcripts\\Chairpersons transcripts 1 0.13%
Interview C11 Files\\Interview transcripts\\Chairpersons transcripts 1 0.22%
Interview C12 Files\\Interview transcripts\\Chairpersons transcripts 1 0.22%
Interview C13 Files\\Interview transcripts\\Chairpersons transcripts 1 0.15%
Interview C14 Files\\Interview transcripts\\Chairpersons transcripts 1 0.17%
Interview C2 Files\\Interview transcripts\\Chairpersons transcripts 1 0.19%
Interview C3 Files\\Interview transcripts\\Chairpersons transcripts 1 0.28%
Interview C4 Files\\Interview transcripts\\Chairpersons transcripts 1 0.29%
Interview C5 Files\\Interview transcripts\\Chairpersons transcripts 1 0.29%
Interview C6 Files\\Interview transcripts\\Chairpersons transcripts 1 0.15%
Interview C7 Files\\Interview transcripts\\Chairpersons transcripts 2 0.49%
Interview C8 Files\\Interview transcripts\\Chairpersons transcripts 1 0.23%
Interview C9 Files\\Interview transcripts\\Chairpersons transcripts 1 0.25%
InterviewCT3 Files\\Interview transcripts\\Technicians transcripts 1 0.09%
Summary
Reference
Text
Word Tree
Folders
15 Items
Files: 15 References: 16
Unfiltered
Type here to search
14:00
17/04/2020

Appendix Y: Query Matrix Results for Dynamics of ICT Adoption

Resources

	Acquisition	Allocation	Utilisation	Prioritisation
Acquisition	20	9	4	6
Allocation	9	2	17	2
Utilisation	4	17	93	43
Prioritisation	6	2	43	27

Leadership

	Communication	Reputation	Support	Motivation
Communication	9	6	2	25
Reputation	6	30	35	2
Support	2	35	38	2
Motivation	25	2	2	11

Adoption behaviours

	Reluctance	Control	Attitude	Herd
Reluctance	28	16	8	4
Control	16	25	9	6
Attitude	8	9	19	13
Herd	4	6	13	20

Empowerment

	Autonomy	Authority	Competence	Experience
Autonomy	9	16	10	7
Authority	16	20	17	2
Competence	10	17	23	31
Experience	7	2	31	17

Appendix Z: Email from the Vice Chancellor

National University of Science & Technology

Webmail

Sibusisiwe dube <sibusisiwe.dube@nust.ac.zw>

FW: Effective Integration of Online Education in African Universities-March 30, 2020 @ 12:00 GMT

1 message

Vice Chancellor <vice-chancellor@nust.ac.zw> 23 March 2020 at 23:05
To: Academics at NUST <academicstaff@nust.ac.zw>
Cc: Dean Students <dean.students@nust.ac.zw>, deans@nust.ac.zw, Pro Vice Chancellor Research and Academic Affairs <pvc.academic@nust.ac.zw>, ICTS Director <icts.director@nust.ac.zw>, "Ms. Novuyo N. T. Bobo"
<novuyo.bobo@nust.ac.zw>, registrar@nust.ac.zw

Dear All:

Concerns have arrived in our inboxes that academics are resistive about online delivery platforms. These have come so far as to be light enough for mobile devices in low bandwidth situations. Students pay much less for these platforms than they pay in monthly rentals. Those in rural areas tend to know what spots near their homesteads to go to for access with their phones and which SIM card to switch to for each spot. It may be just behind one of the buildings there. In the end, we must seriously consider everything that will prevent the cancellation of an entire Semester with only three weeks of learning to go. If the foundation has been laid well in the first nine weeks, surely let us give all means available a try. At least, this Webinar might clear our minds about the intuitive platforms currently available. They are often usable even for recording your face-to-face lectures. Use the later to help students that miss a class for one reason or other, or for future lectures where the lecturer is incapacitated for an entire week, for instance.

Best Regards,

Professor Mqhele Dlodlo, PhD (FZweIe; Pr.Eng. (ECZ); FZAS)

Vice-Chancellor

National University of Science and Technology (NUST)

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- For this option, the institution pays on behalf of the students.
- This option will be a data-only package.
- The institution will pre-pay first for the data they need either monthly or once-off per every Semester per student.
- The University/Institution will share student numbers and then select a data plan they require from the ones shown below. / NetOne.
- Then data will be loaded and will be valid for 30 days period. These bundles are heavily discounted and will not be rolled-over b
- All University e-services will be white-listed for these bundles allowing students access to these services for free.

Scholar Data Bundle	Price	Data (Mb)	PPMB	Validity
Heavy	$150.00	10 GB	0.015	30 Days
Extreme	$200.00	15 GB	0.013	30 Days
Intense	$250.00	20 GB	0.0125	30 Days