A 4IR FRAMEWORK FOR ICT EVALUATION: A CASE FROM SOUTH AFRICAN SMEs

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I declare that the above dissertation/thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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SIGNATURE **DATE**

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DEDICATION

This study is dedicated to my spouse Brenda and my beautiful daughter Eliana.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ARR	Account Rate of Return
CFA	Confirmatory Factor Analysis
DCT	Dynamic Capability Theory
DT	Digital Technology
DTs	Digital Technologies
EFA	Exploratory Factor Analysis
FEM	Financial Evaluation Model
ICTs	Information and Communication Technologies
IS	Information System
ISSM	Updated Information Systems Success Model
IRR	Internal Rate of Return
NPV	Net Present Value
PBK	Payback
ROI	Return on Investment
ROV	Real Option Value
SA	South Africa
SEM	Structural Equation Modelling
SMEs	Small and Medium Enterprises
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
UTAUT	Unified Theory of Acceptance and Use of Technology

ABSTRACT

The rapid advancement of information and communication technologies (ICTs) and the immense benefits they present to organisations have made ICT innovations prominent. However, there is a constant contention between ICTs that already exist in organisations and emerging digital technologies (DTs). The exponential rate at which these DTs evolve often overwhelms decision-makers. This study focused on the decisions of small medium enterprises (SMEs) whether to adopt emerging DTs or to continue using their existing ICTs: SME owners need to evaluate existing ICTs to gauge their usefulness before adopting emerging DTs. Existing decision tools are often insufficient, being based only on either financial evaluation models or ICT usage/adoption models. This study therefore reviewed ICT use, acceptance and adoption theories, as well as financial models, in identifying both the non-financial and financial factors relevant to the evaluation of existing ICTs. Using the Updated Information Systems Success Model as the base model, the study developed an integrated conceptual framework for the evaluation of existing ICTs. The conceptual framework was tested per the positivist philosophical paradigm using data collected from SME owners. Structural equation modeling was used to test and validate the framework. The key findings from the study are that the psychological views and personal experiences of SME owners play the most important role in the evaluation of existing ICTs; and are primarily driven by the social environment surrounding them. The thesis recommends that SME owners *should not* base their decisions to continue using the existing ICTs on their psychological views and personal experiences only. Such owners may be deceived into believing that emerging DTs are better than the existing ICTs, or vice versa. Rather, SME owners should also consider the performance of software and hardware; and the quality of the information from the existing ICTs. Some features of the existing ICTs, such as database, network, and cloud computing, do not seem to matter to the SME owners; nevertheless these factors are important to consider. The study contributed to Information Systems theory by scoping a body of literature specific to the evaluation of existing ICTs within SMEs in South Africa. The study also contributes to practice, in creating a framework that could assist SME owners to objectively evaluate existing ICTs before adopting emerging DTs. Future research, however, should consider qualitative methods to elicit other factors which may be relevant to the evaluation of existing ICTs.

PUBLICATIONS

Journal

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CHAPTER 1: INTRODUCTION TO THE STUDY

1.1. Introduction

Information and Communication Technologies (ICTs), more commonly referred to as digital technologies (DTs) (Ibem, and Laryea, 2014; Chowdhury, Adafin and Wilkinson, 2019; Bosch-Sijtsema, Claeson-Jonsson, Johansson and Roupe, 2021), are evolving at such a rapid pace that users and organisations are often left overwhelmed. Critical decisions must be made on which DTs to use. This era, dubbed by Klaus Schwab (2016) the Fourth Industrial Revolution (4IR), has seen DTs evolving exponentially. The 4IR is transforming the way we live, interact, and work (Schwab, 2016). The 4IR includes digital innovations in areas such as machine learning, artificial intelligence (AI), nanotechnology, blockchain, robotics, quantum computing, biotechnology, the Internet of Things (IoT), and 3D printing (Schwab, 2016).

Many organisations have experienced a loss in revenue, owing to an impulsive adoption of emerging DTs (Mokaya and Njuguna, 2017). This study focused on the role that these emerging DTs play in the success or failure of Small and Medium Enterprises (SMEs); and how these challenges may be mitigated.

SMEs are vital to low-income countries' economic development (Nowakowska-Grunt, Kowalczyk and Wojtaszek, 2018; Bruwer, Hattingh and Perold, 2020), driving economic recovery globally, thus contributing to economic growth (Beynon, Jones and Pickernell, 2018; Bruwer, Hattingh and Perold, 2020). SMEs are therefore the engines which power a country's economic growth. Such enterprises consequently play a pivotal role in alleviating poverty by creation of employment, the nurturing of an entrepreneurial culture, supporting large-scale industries, and per the unlocking of new business opportunities (Nowakowska-Grunt, Kowalczyk and Wojtaszek, 2018; Razak, Abdullah and Ersoy, 2018; Bruwer, Hattingh and Perold, 2020). Given that SMEs constitute the backbone of the country, there is a pressing and prevailing need to support SMEs. However, SMEs are confronting several challenges in the 4IR era.

Decision-makers for SMEs require insight, in making adoption decisions. Adoption decisions, in this study, comprise two alternatives: either to continue using existing ICTs within their enterprise, or to adopt new, emerging DTs. In this thesis, the term ‘existing ICTs’ refers to those DTs that have been in use within the SME, and are on the verge of being replaced by other ‘emerging DTs’.

The thesis argues that a framework is needed to enable SMEs to evaluate their existing ICTs before adopting emerging DTs. Such an assessment will help SMEs better assess whether their existing ICTs are still useful. A framework of this nature is even more important in the current times of COVID-19: DTs have become the epicentre of most operations, if not all. SMEs that were not digitally prepared have been most affected (Haider Syed, Khan, Raza Rabbani and Thalassinos, 2020).

Emerging DTs have become even more relevant and a must for every SME, owing to the circumstances that many SMEs have found themselves in because of the Covid-19 pandemic. Many SMEs have been found wanting in terms of their technological capacity and capabilities. Such a time has demanded that many SMEs work remotely or virtually. However, to be able to do that, one needs the proper DTs, which most SMEs do not have.

The vast majority of SMEs have limited knowledge of, or interest in, environmental drivers. Such SMEs generally experience difficulties integrating environmental drivers into their decision-making activities (Razak, Abdullah and Ersoy, 2018; Kim, Joshi and Lee, 2019). An apposite framework will minimise barriers to adopting emerging DTs; or, alternatively, such a framework will ensure smooth continuance of existing ICTs.

Common challenges that affect SMEs in the 4IR era are: lack of technical knowledge, failure of government and top-management support, improper infrastructure, high costs and low funds, poor evaluation of economic benefits, and a lack of attention to human factors (Urban and Naidoo, 2012; Adebayo, Balogun and Kareem, 2013; Borsci, Uchegbu, Buckle, Ni, Walne and Hanna, 2018). SMMEs are not ready for the adoption and implementation of 4IR DTs as are larger firms (Gumbi and Twinomurinzi, 2020). In South Africa specifically, organisations still have a long way to go to

implement and incorporate Industry 4.0 technology concepts (Marnewick and Marnewick, 2020). Limitations such as finances require SMEs to be sure about the emerging DTs before their purchase; otherwise SMEs will risk wasting money which is already a scarce resource to them. As a result, prior to purchasing and adopting emerging DTs, a thorough evaluation of existing ICTs is necessary. However, there is little research on a framework which is suitable to employ for evaluating existing ICTs (Chaysin, Daengdej and Tangjitprom, 2016) before adoption of new, emerging DTs. This situation has forced SMEs to rely on use of pre-adoption models and inadequate financial models in evaluating existing ICTs.

This study suggests that, before adopting emerging DTs, SMEs must evaluate their existing ICTs. The purpose of evaluating existing ICTs is to understand how and whether indeed they are still contributing to performance (Ceric, 2015). This evaluation process could assist SMEs to analyse the value to them of continuing with their existing ICTs, or whether to adopt emerging DTs. SMEs must therefore rely on a framework that can assist them with the evaluation process. This current study thus intended to develop a framework that SMEs can use for such an undertaking, which, in turn, will lead to continued use of the most appropriate technologies for their enterprise.

1.2. Research Problem

The challenges of futile and inadequate evaluation of existing ICTs are known to most SMEs. Some precursors to this state might be insufficient time to conduct the evaluation, no fitting framework or methods on which to evaluate existing ICT investments (Chaysin, Daengdej and Tangjitprom, 2016). In many instances, SMEs have rashly adopted emerging DTs because others have done so (Wong, Leong, Hew, Tan and Ooi, 2020; Jere and Ngidi, 2020). Such impulsive decisions are driven by environmental forces (such as competitive pressure, and today − COVID-19) (Wong, Leong, Hew, Tan and Ooi, 2020; Jere and Ngidi, 2020). Other SMEs could have neglected adoption for a variety of reasons, including finances (Ghobakhloo and Ching, 2019; Madichie, Mpiti and Rambe, 2019). Some SMEs have assessed the effectiveness of the existing ICTs to gauge their relevance and productivity; however,

this has been conducted per an inadequate or improper framework (Chaysin, Daengdej and Tangjitprom, 2016). The lack of a framework solely and purposely designed to evaluate existing ICTs within an SME, has impacted negatively upon such SMEs.

Information systems' success, usage, acceptance, and pre-adoption models, such as the information systems success model (ISSM), the unified theory of acceptance and use of technology (UTAUT), and the technology acceptance model (TAM), amongst other models, have been used by many SMEs to assess existing ICTs. Others have used sophisticated financial models such as internal rate of return (IRR), real option value (ROV), pay-back period (PBK), return on investment (ROI), net present value (NPV), and account rate of return (ARR), to evaluate existing ICT investments (Lefley, 2013; Chaysin, Daengdej and Tangjitprom, 2016). However, the latter models only evaluated the financial facets of the investment (Lefley, 2013; Chaysin, Daengdej and Tangjitprom, 2016), thus neglecting the non-financial aspects of the investment (Orlikowski and Iacono, 2001). The former models were not purposefully and originally designed to evaluate existing ICTs*,* but rather, other aspects, such as IS success, and pre-adoption of emerging DTs, usage, and acceptance.

The lack of an adequate framework for existing ICT evaluation has led to many SMEs either hurriedly adopting or completely neglecting the adoption of emerging DTs. Uninformed decision-making has cost SMEs much revenue. The development of a framework will fill a gap, providing guidelines for the evaluation of existing ICTs, before SMEs attempt to adopt emerging DTs. The developed framework goes beyond financial considerations of existing ICT evaluation, incorporating non-financial evaluation. To achieve this, this study sought to establish factors relevant to the evaluation of existing ICTs.

1.3. Research Objective

Based on the research problem identified from literature, the research objective was to develop a framework that could be used by SME owners to evaluate existing ICTs before adopting emerging DTs. The study used South Africa for its context.

1.3.1 Specific secondary objectives

To address the main objective of the study, the following specific secondary objectives were formulated:

1. To explore and determine both financial and non-financial factors relevant to the evaluation of existing ICTs. Such an evaluation would be a decisive factor in either adopting or discarding emerging DTs.
2. To explore and classify determined non-financial factors, such as technological, organisational, individual, and social factors needed in evaluating existing ICTs. Such would lead to the correct decision on adoption or rejection of emerging DTs.
3. To investigate successful financial models that have been used to evaluate ICT investments.
4. To use both the financial and non-financial factors determined, in developing an integrated conceptual framework. Such can inform effective evaluation of existing ICTs before deciding on adopting emerging DTs.
5. To validate the conceptual framework for evaluation of existing ICTs.

1.4. Research Questions

To achieve the set objectives, the following research question was formulated:

How can SMEs evaluate their existing ICTs before possibly adopting emerging DTs?

1.4.1 Specific secondary research questions

To answer the main research question of the study, the following specific secondary research questions were answered:

1. What are both the financial and non-financial factors relevant to the evaluation of SMEs' existing ICTs before decisions are made on either adopting or rejecting emerging DTs?
2. What are the technological, organisational, individual, and social factors needed in the evaluation of existing ICTs before deciding whether to adopt or reject emerging DTs?
3. Which are the successful financial models that have been used in evaluating ICT investments?
4. How can the determined financial and non-financial factors be integrated into a conceptual framework to inform the effective evaluation of existing ICTs? This would help in decision-making apropos of adopting emerging DTs.
5. How can the conceptual framework for evaluation of existing ICTs be validated?

1.5. Structure of the Thesis

Chapter 1 introduced the research problem, objective, research questions, and motivation of the study. It also presented contributions which will be further discussed in Chapter 7.

The theoretical foundational perspectives as they relate to ICTs and SMEs in general are discussed in Chapter 2. This chapter also includes a concise definition of terms that will be used throughout the study. The chapter concludes with an overview of how South African SMEs are currently evaluating their existing ICTs.

The literature relating to the theoretical frameworks of information systems is presented in Chapter 3. The chapter also includes a comprehensive discussion of major and successful theories that have influenced ICT adoption, usage, and acceptance. In reviewing these models, the study illustrates the current gap in knowledge as far as evaluation of existing ICTs is concerned. The study then attempts to indicate how the reviewed theories fail to evaluate existing ICTs before deciding on

adoption or rejection of emerging DTs. In the light of this, the study proposed the best form of integrated framework, giving ways in which it can be developed. Furthermore, this chapter provides an overview of the successful financial models used in the evaluation of ICT investments, including ROI, ARR, PBK, NPV, IRR, and ROV. The chapter further identifies ISSM as a theory used to underpin the research. In conclusion, the conceptual framework which informed the study is presented, and hypotheses are drawn.

Chapter 4 discusses the various research methodologies used in each phase of the research design, together with the motivation/s for their selection. The methods and instruments used to collect data, as well as sampling and analysis methods, are outlined. Furthermore, the pre-analysis process is discussed. Last, the chapter details the specific procedure followed when conducting structural equation modelling and multi-group analysis in AMOS.

The analysis of the collected data is covered in Chapter 5 using the methods described in Chapter 4. It also summarises the analysis' findings. This chapter presents the results obtained by extracting various statistics from the collected data. Structural equation modelling is used to validate the developed framework by testing the hypothesis.

Chapter 6 discusses the interpretation of the results in relation to literature and their practical and theoretical implications. The practical and theoretical implications were for research objectives, research questions, and research hypothesis.

The final chapter of the thesis, Chapter 7, summarises the contribution of this research study to the body of abstract knowledge while also providing a practical application. Furthermore, the limitations faced by this study are discussed. Recommendations for possible future research are made to address the limitations and shortfalls of this study. Last, the study draws conclusions on the entire research endeavour.

CHAPTER 2: LITERATURE REVIEW

Chapter 1 presented a justification for research into existing ICT evaluation, before attempting to adopt emerging DTs. The chapter provided highlights of the challenges faced by SMEs when considering adoption decisions. This, in turn, introduced the problem statement, research objectives, and questions which the study sought to answer. Chapter 2 will review literature related to the study, by discussing the theoretical perspectives of ICTs and emerging DTs in the 4IR. The section is divided into discussions of SMEs, ICT, emerging DTs in the 4IR, components of DTs, and the state of existing ICTs evaluation by South African SMEs. The purpose is to elucidate the components of DTs and current situation of SA SMEs.

2.1 Small and Medium Enterprises

In an effort to concisely explore SME literature, this section will be divided into the following categories: SMEs definition, the role of SMEs, SMEs' locations, and SMEs' operations.

2.1.1 SMEs

SME is an acronym for a Small and Medium Enterprise. It has several contextual definitions − different countries employ different definitions of SME (Fan, 2003; Maziriri, 2017). Despite their well-known significance, SMEs still lack a widely agreed definition, with wide differences across countries (Lampadarios, 2016). In the United States, small businesses are characterised as enterprises with less than 500 employees (Lampadarios, 2016). SMEs in Japan are businesses with a workforce of four to two hundred workers (Lampadarios, 2016). The UK Companies Act of 2006 defines SMEs as companies that meet any two of the following requirements: an annual turnover of below £6.5 million; a balance sheet total below £3.26 million; and total employees below 50 (Lampadarios, 2016). At least two of the following conditions must be met by a medium-sized business: have a net balance sheet of less than £12.9 million and a maximum of 250 workers; and an annual turnover of less than £25.9

million (Lampadarios, 2016). The definition of a small business in Pakistan is one with a paid-up capital below Rs.25 million, total number of workers below 250, and annual sales below Rs.250 million (Zafar and Mustafa, 2017). In the context of South Africa (SA), an SME is defined according to its annual turnover, number of employees, or gross assets. The SA National Small Business Act no. 102 of 1996 places types of SME into three categories: annual turnover, number of employees, and gross assets (excluding fixed property) (Falkena *et al.*, 2002; Maziriri, 2017). An organisation can be one of the following: micro, very small, small, and medium enterprise. Table 2.1 provides concise definitions of organisation that fall into the SME category, as adopted from Falkena *et al.* (2002).

Table 2.1: Definition of SMEs as stated in the SA National Small Business Act Source:

Size	Number of Employees	Annual Turnover	Gross Assets, excluding Fixed Property
Micro	< 5	< R150 Th	< R100 Th
Very Small	>10 and < 20	> R200 Th and < R500 Th	> R150 Th and < R500 Th
Small	< 50	> R2 Mil and < R25 Mil	> R2 Mil and < R4.5 Mil
Medium	> 100 and < 200	> R4 Mil and < R50 Mil	> R2 Mil and < R18 Mil

Falkena *et al.* (2002)

2.1.2 The role of SMEs

SMEs are vital to low-income countries' economic development (Margaretha and Supartika, 2016; Beynon, Jones and Pickernell, 2018; Nowakowska-Grunt, Kowalczyk and Wojtaszek, 2018; Razak, Abdullah and Ersoy, 2018; Bruwer, Hattingh and Perold, 2020). In Russia and China, SMEs constitute 90–99.9 per cent of all enterprises and 50–60 per cent of employment in the world (Fan, 2003). SMEs account for 91 per cent of formal business institutions in South Africa, contributing between 52 and 57 per cent of the country's overall GDP while employing 60 per cent of the workforce. (Falkena *et al.*, 2002; Abor and Quartey, 2010; van Scheers and Makhitha, 2016; Fatoki, 2019a). This is also the case in Malaysia and other low-income countries (Falkena *et al.*, 2002; Abor and Quartey, 2010; Selamat, Jaffar and Kadir, 2011).

Sometimes SMEs are the only source of employment for low-income workers in rural areas and non-affluent regions, hence are also crucial for poverty alleviation: (Fan, 2003; van Scheers and Makhitha, 2016; Beynon, Jones and Pickernell, 2018; Nowakowska-Grunt, Kowalczyk and Wojtaszek, 2018; Razak, Abdullah and Ersoy, 2018; Fatoki, 2019a; Bruwer, Hattingh and Perold, 2020); and they are the engine of growth in being the largest provider of employment in most low-income countries (Fan, 2003; van Scheers and Makhitha, 2016; Beynon, Jones and Pickernell, 2018; Nowakowska-Grunt, Kowalczyk and Wojtaszek, 2018; Razak, Abdullah and Ersoy, 2018; Fatoki, 2019a; Bruwer, Hattingh and Perold, 2020). When it comes to trading, SMEs also aid as an efficient and competitive market: they are crucial subcontractors in the downscaling process, privatisation and restructuring of large organisations (Hassbroeck, 1996; Berry, von Blottnitz, Cassim, Kesper, Rajaratnam and van Seventer, 2002; Falkena *et al.*, 2002; Abor and Quartey, 2010). Their heavy presence creates competitive market pressure.

In the context of South Africa, the key problem currently faced by the South African government is the transition to an open-market economy from an apartheid regime (Gono, Harindranath and Berna Özcan, 2016). This transition enforces an urgency to develop and establish the SME sector as part of a wider economic and social reformation (Gono, Harindranath and Berna Özcan, 2016). Given the positive contribution that SMEs offer to the GDP, and the country in general, any efforts lavished on their support would, most likely, result in positive economic growth and a decline in unemployment (Barba-Sánchez, del Pilar Martínez-Ruiz and Jiménez-Zarco, 2007; van Scheers and Makhitha, 2016; Fatoki, 2019a). Therefore, it is of the utmost importance to assist SMEs in grounding their adoption decisions in the use of a proper framework especially designed to evaluate existing ICTs before attempting to adopt emerging DTs.

2.1.3 SMEs' locations

SMEs operate in all of high-income, middle-income, and low-income countries (Falkena *et al.*, 2002; Abor and Quartey, 2010; Chimucheka and Mandipaka, 2015); they operate in large and small towns, rural and urban areas. The employment rates

in small-town SMEs grow faster than in large towns and cities, as does turnover in rural and small-town manufacturing firms (Cosh and Hughes, 1996; Fatoki, 2019a). However, SMEs operating in large cities act differently from those located on the outside; hence they are affected differently in factors related to growth (Voulgaris, Asteriou and Agiomirgianakis, 2003; Chimucheka and Mandipaka, 2015). The general assumption is that SMEs in large cities are likely to face tougher competition than their counterparts in small cities and rural areas; this is because most SMEs operate in large cities. This is also the case for SMEs that operate in industries − some industries offer more competition than do others. This study will focus on all SMEs in South Africa, regardless of their location and industry of operation.

2.1.4 SMEs operations

The way in which SMEs operate depends on their size, amongst other factors. Medium enterprises are typically expected to have certain advantages over small enterprises and are thus expected to grow more rapidly (Bartlett and Bukvič, 2001; Quartey, Turkson, Abor and Iddrisu, 2017). However, other studies have alluded to medium enterprises growing more slowly than small enterprises; this is because smaller enterprises are more flexible and adaptable (Bartlett and Bukvič, 2001). In addition to this reason, when price falls, medium enterprises react by reducing output, while small enterprises do not react (Jovanovic, 1982). Seeing that small enterprises are initially uncertain regarding their costs and expenses, they enter the market at less than minimum efficient scale, growing over time to reach it (Jovanovic, 1982). This might be the case when it comes to emerging DTs: smaller enterprises would not hurry to purchase such, having limited finances compared with medium enterprises. Therefore, for smaller enterprises, a comprehensive analysis of whether their existing ICTs are still useful is of paramount importance.

2.2 Challenges faced by Small and Medium Enterprises

Challenges encountered by SMEs in low-income countries are the same as those in high-income countries (Khalique, Isa, Shaari, Abdul and Ageel, 2011; Chimucheka and Mandipaka, 2015; Fatoki, 2019b). The only noteworthy difference is that the

impact of challenges weighs more heavily on SMEs in low-income countries than it does in high-income countries (Khalique *et al.*, 2011; Chimucheka and Mandipaka, 2015; Osano and Languitone, 2016; Maziriri, 2017; Fatoki, 2019b). Other common factors that hamper the success of SMEs in low-income countries are lack of technical knowledge, market research skills, managerial skills, planning skills, environmental factors such as competition, and inexperience in the field of business (Baron, 2007; Olutunla and Obamuyi, 2008; Schwartz and Hornych, 2010; Urban and Naidoo, 2012; Adebayo, Balogun and Kareem, 2013; Chimucheka and Mandipaka, 2015; Osano and Languitone, 2016; Maziriri, 2017; Fatoki, 2019b). The same factors also affect how SMEs adopt emerging DTs in low-income countries (Adebayo, Balogun and Kareem, 2013).

SA SMEs are no exception, and are not immune to the challenges that affect SMEs in general. SMEs in South Africa commonly experience difficulties accessing credit from financial institutions such as banks (Brink, Cant and Ligthelm, 2003; Osano and Languitone, 2016; Naude and Chiweshe, 2017). The South African government has successfully developed incentive programmes to support SMEs (Mueller and Thomas, 2001; Maleka and Fatoki, 2016). However, owing to corruption and the unfair distribution of incentives, some SMEs have failed to benefit from these programmes. Some SMEs are not even aware of such initiatives that the government has put in place (Maleka and Fatoki, 2016). Therefore, the decision to purchase and adopt emerging DTs, and the consequent abandoning of existing ICTs should be taken with caution, since SMEs do not have the luxury of finances.

SMEs face common challenges, except that the impact weighs more on SMEs in low-income countries than it is for SMEs in high-income countries. Regardless of that, this study deemed it necessary to equip decision-makers of SMEs with a framework that can assist them in evaluating their existing ICTs before they attempt to adopt emerging DTs. This process should result in SMEs' continued use of the most appropriate technology, which, in turn, is likely to give them a competitive advantage. This is the focus of the study.

2.3 Information and Communication Technology/Digital Technology

ICT is the abbreviation of Information and Communication Technology. As much as the concept is regarded as universal in nature, various authors have defined it in different ways, with authors citing it differently. The term digital technology (DT) has been used interchangeably with ICT (Ibem, and Laryea, 2014; Chowdhury, Adafin and Wilkinson, 2019; Bosch-Sijtsema *et al.*, 2021). Even though definitions and synonyms of ICT are numerous, they still share much common ground and drive towards the same concept. In this study, the term DT will be used as the umbrella term covering ICT and new 4IR-related technologies. The subsequent section discusses various definitions of DT and the definition adopted in this study. Components that make up a DT are identified and discussed.

DT is any technology which facilitates the gathering, consumption, production, distribution, and storage of information (Torero and von Braun, 2006; Jimoh and Salawu, 2010; Ibem, and Laryea, 2014). ICTs that allow the creation, storage, and handling of information, as well as various modes of communication between humans and electronic systems and among electronic systems in digital, binary machine language, are generally referred to as DTs (Lloyd, 2005; Jimoh and Salawu, 2010; Ibem, and Laryea, 2014; Chowdhury, Adafin and Wilkinson, 2019; Bosch-Sijtsema *et al.*, 2021; Bosch-Sijtsema *et al.*, 2021). A DT consists of different components, like hardware (physical devices and peripherals); software applications (operating systems and application software), network connectivity (local networking infrastructure, access to the Internet and video conferencing) and storage (databases and cloud services). This study defines DT as any form of technology, or assortment of various disparate technologies connected, which accept data as input, and can process that data to render information as output, which can be stored for later access. When DT is referred to as DTs, such incorporates various disparate technologies (components) interlinked, to facilitate communication. The term DTs, in its plural form, will thus be referenced, going forward. Such DTs are most commonly used in SMEs,

as they facilitate central storage (databases and cloud) and some means of communication (network) amongst users located in different locations.

Although DTs have gradually evolved over time, they still maintain the same definition. Therefore, emerging DTs are no different to existing ICTs in terms of composition, except for their capabilities. Emerging DTs in the 4IR do come with better and more advanced capabilities than existing ICTs. The next section will discuss emerging DTs in the 4IR.

2.4 Emerging DTs in the Fourth Industrial Revolution

Emerging DTs in the 4IR era, such as AI, IoT, virtual reality, and robotics are evolving and transforming people's work and lives. As a result, SMEs must be adaptable enough to cope with these changes. Previous industrial revolutions rescued society from animal power, facilitated mass manufacturing, and delivered digital capabilities to billions of people (Schwab, 2016). The current revolution (4IR) is marked by a number of new DTs that combine the physical, digital, and biological realms, affecting all disciplines, societies, and sectors, and also challenging assumptions about what it means to be human (Schwab, 2016).

Emerging DTs in the 4IR offer the ability to integrate social, virtual, and physical worlds among people, between things, between people and things, and so on. Emerging DTs can enhance more than operational service quality: they also offer insights into, and support in decision-making. The fundamental benefit of emerging DTs is their capacity to integrate intelligence and networking systems (Li, Hou and Wu, 2017). SMEs in the manufacturing sector are aware, capable, and willing, and have the ability to identify the challenges associated with emerging DTs. Unfortunately, however, they are not ready to adopt these emerging DTs in the 4IR (Gumbi and Twinomurinzi, 2020). The adoption and implementation of these emerging DTs depends on size of the firm (Suresh, Hemamala and Ashok, 2018). Medium-sized enterprises have already started investing in DTs, while small-sized enterprises are still struggling to decide their long-term benefits (Suresh, Hemamala and Ashok, 2018). The next paragraphs

describe some of the latest emerging DTs, their capabilities, and how SMEs are leveraging on these capabilities.

IoT is a global network system that uses data collection and networking capability to link physical and virtual objects (Yunli and Xiuting, 2010). The Internet of Things describes situations in which network access and computational capacities are extended to artefacts, sensors, and ordinary products that aren't typically thought of as computers, allowing these entities to produce, share, and consume data with limited human interaction (Rose, Eldridge and Chapin, 2015). The term was first used by Kevin Ashton in 1999 to describe a system in which sensors could connect objects in the physical world to the Internet. IoT uses technologies such as radio-frequency identification (RFID), Bluetooth and Wifi to count and track goods through Internet connections without the need for human intervention (Rose, Eldridge and Chapin, 2015). IoT offers great opportunities for more efficient manufacturing, new data driven services, and increased automation (Nylander, Wallberg and Hansson, 2017).

For SMEs with limited or no IT in their processes, requirements are too high to enter the IoT world. SMEs with no in-house software, hardware, sensors, and big data skills face many challenges when implementing IoT (Nylander, Wallberg and Hansson, 2017). For small enterprises, it might not be viable to implement IoT, the need being minimal (Nylander, Wallberg and Hansson, 2017). In high-income countries such as China, majority of organisations that have managed to implement IoT are SMEs (Yunli and Xiuting, 2010), which have dominated the IoT industry (Yunli and Xiuting, 2010). However, in low-income countries such as SA and other sub-Saharan African countries, a great deal of work must be done before SMEs can adopt and implement the IoT (Atayero, Oluwatobi and Alege, 2016).

Artificial intelligence (AI) is a collection of advanced DTs that allow machines to perform cognitive functions associated with human minds and intelligence, such as perceiving, reasoning, comprehending, interacting, problem-solving, learning, and creativity (Russell and Norvig, 2016; Johansson and Persson, 2018). AI examines how a human brain thinks, and how people learn and decide when trying to solve a problem (Ulas, 2019). Intelligent software systems that can be embedded in computer systems

like chatbots (such as MedWhat, World Health Organisation COVID-19, National Geographic, Lidl's Winebot, Google assistant, Alexa, or Siri) and robots, instruct computer systems or machines to imitate and mimic human beings. AI has been used in corporate, law, finance, economics, marketing, and accounting (Rauch-Hindin, 1985), engineering (Pham and Pham, 1999), medicine and healthcare (Ramesh, Kambhampati, Monson and Drew, 2004; Bollier, 2017), self-driving cars, and robotics (Bollier, 2017). Even though SMEs suffer from a lack of resources compared with large companies, they are at the forefront of adopting AI for marketing purposes (Savola, Tuohimaa and Berg, 2018). Lack of skills such as accounting skills (Ismail, 2002), has promoted development of intelligent account systems to add to their advantages (Tarmidi, Rozalan, Rasli, Roni and Alizan, 2018).

Also, during these current challenging times of the outbreak of Covid-19, SMEs have been on the receiving end of most of the challenges. SMEs have not been able to operate, owing to the lockdowns declared in most countries across the globe. Only SMEs that had already adopted emerging digital platforms such as Zoom, Microsoft Teams, cloud computing, IoT, amongst others, have been able to continue to work. Most of the SMEs require people to be in the office for them to be able to collaborate and do their work. However, with the use of emerging digital platforms such as Microsoft Teams, such collaborations can be accomplished virtually, for example, SMEs in the IT space of software development, business-intelligence development, networking support, amongst others, are able to work remotely. As such, systems can be configured remotely by the use of emerging digital platforms, for instance, Microsoft Teams and Zoom. However, not all SMEs will be able to work remotely and virtually. SMEs in the construction space are an example. Even though meetings can be conducted virtually, people still need to be in the field to complete the construction work; hence emerging digital platforms such as Microsoft Teams will not be of full help to them. Therefore, for such SMEs, there is need to conduct an evaluation of their existing ICTs. Decisions must be made whether to replace them; while for IT-type SMEs, there is need to adopt emerging DTs for them to be able to continue working, regardless of any lockdown.

These intelligent capabilities are enticing for SMEs. SMEs are forced to proactively react, owing to the rate at which DTs are evolving. This study proposes that a dichotomous option be noted; the choice is either to continue using existing ICTs, or to adopt emerging DTs. The goal is to ensure that SMEs are using the appropriate DT at any given time. The next section details the components that make up existing ICTs and emerging DTs.

2.5 Components of Existing and Emerging DTs

Information systems (IS) researchers tend to assume that any DT is a single, steady, isolated, self-sufficient, stand-alone and fixed investment (Orlikowski and Iacono, 2001). People, information, data, software, hardware, network, and database are all components of DTs, which are not inherently single and distinct entities (Whitman and Mattord, 2012; Bidgoli, 2017). These are the most basic components that every DT (existing or emerging) exhibits; these components are discussed below:

a. **People:** people, as a resource, exist in two forms, namely, end users, and specialists, such as developers. This study will focus on the end users, who play a pivotal role in the evaluation and adoption process. End users are people who use the DTs, or the output from such. These types of users include accountants, salespersons, engineers, clerks, customers, and managers. This study focuses on an SME owner as an end user of the existing ICTs under study. Henceforth, end users will be termed SME owners.
b. **Data** refers to the raw material input into the DTs. Data can assume many forms, including text data, image data, alphanumeric data, and audio data. All these forms of data are processed into useful output called information.
c. **Information:** This component is an output from the processing of data. Information consists of simplified analysed data such as total sales per year taken from a list of all sales. This can be done by tools such as SQL and ad-hoc processing DTs.
d. **Hardware:** includes the physical components of DTs. Hardware consists of a variety of interconnected peripheral devices. Examples are mice, keyboards, and storage media, such as hard drives.

e. **Software:** software components include all sets of information-processing instructions. There are two categories of software − application software and operating systems. Application software is developed, or designed, for a specific task or purpose. Examples of application software include database management systems (DBMS), spreadsheets, and word processors. Examples of operating systems are: Linux, Windows 7, UNIX, and Windows XP.
f. **Database:** a database is a collection of related data that can be stored in a central location. It may be either structured or unstructured data collected in an organised manner for easy accessing, managing, and updating.
g. **Network:** networks (such as the intranets, extranets and Internet) have become indispensable to the successful operation of all types of SMEs. No SME owner operates alone − some communication with other user/s or customer/s continually takes place. Most SMEs now use a central point to store their data and digital network technologies. The Internet, intranets and extranets all play a crucial role in the success of this process by providing a means to access this data from within, outside, and between SMEs (Ion and Andreea, 2008; Khan and Al-Yasiri, 2016).

What constitutes the difference between existing ICTs and emerging DTs is the more advanced capabilities that emerging DTs bring. Apart from the basic components, emerging DTs also have other components such as cloud computing. Most SMEs are slowly moving away from hosting their own data servers in-house, owing to security and cost implications (Senarathna, Wilkin, Warren, Yeoh and Salzman, 2018). This role is consequently outsourced to a third-party service which hosts their servers online. This is termed cloud computing. Most SMEs are migrating to cloud computing as it provides easy and cost-effective solutions to complex storage problems, along with myriad options facilitated by the cloud environment (Assante, Castro, Hamburg and Martin, 2016; Senarathna *et al.*, 2018).

Cloud computing is a computing technique in which versatile and adaptable information-technology-related abilities are given as support for outside clients utilising Internet advancements (Cearley, 2010; Khan and Al-Yasiri, 2016). A cloud is an

Internet-based environment which provides shared digital resources, including hardware, software, data, and information (Buyya, Yeo and Venugopal, 2008; Danielson, 2008; Khan and Al-Yasiri, 2016). Cloud is therefore an information system component worth investigating. These components describe the characteristics of DTs. Henceforth, they will be termed technology factors. This study will investigate the following six components of DTs having an influence on the evaluation of existing ICTs: hardware, software, network, database, information, and cloud computing. Data component was not investigated: it is not ideal to evaluate an entity based on the input (data), but rather on the output (information).

2.6 Current Evaluation of Existing ICTs by SMEs

The adoption and use of emerging DTs is widely viewed as a critical factor in ensuring that SMEs stay competitive in the emerging global digital market (Selamat, Jaffar and Kadir, 2011; Abd Aziz and Samad, 2016; Sunday and Vera, 2018; Casidy, Nyadzayo and Mohan, 2019). Emerging DTs such as AI thus offer the latest specifications and capabilities, which stimulate growth, and subsequent survival, of SMEs in highly turbulent business environments. However, not all new specifications and capabilities are essential for stimulating business growth; and thus an SME owner should evaluate existing ICTs before adopting new, emerging DTs.

The term DT evaluation is often not used precisely (Farbey, Land and Targett, 1999). In some instances, it refers to an event which takes place at the beginning of a project so as to decide whether a project should continue, an event commonly termed a feasibility study. Other authors (Lefley, 2008, 2013) have referred to this decision process as appraisal (Farbey, Land and Targett, 1999; Lefley, 2008, 2013). Classic and recent studies (Bandura, 1977; Oliver, 1980; Ajzen, 1991; Thompson, Higgins and Howell, 1991; Davis, 1993; Cheah, Yap, Unnithan, Moses, Diong and Er, 2014; Husin, Evans and Deegan, 2016; Acheampong, Zhiwen, Antwi, Otoo, Mensah and Sarpong, 2017; Bailey, Pentina, Mishra and Mimoun, 2017; Hoque and Sorwar, 2017; Rahi and Ghani, 2018; Alalwan, Baabdullah, Rana, Tamilmani and Dwivedi, 2018) have defined this kind of event as DT adoption. The term “evaluation” refers to a constant post-investment exercise that involves a post-implementation analysis of realised benefits

(Farbey, Land and Targett, 1999). Other authors (Kwon and Chidambaram, 2000; Venkatesh and Davis, 2000; Tibenderana and Ogao, 2008; Alwahaishi and Snásel, 2013; Madigan *et al.*, 2016; Safi, Thiessen and Schmailzl, 2018; Raza, Shah and Ali, 2019) have referred to this process as acceptance and use. In this research study, the definition of DT evaluation is based on a post-investment point of view, thus post adoption, post usage, and post acceptance.

For this study, evaluation is thus the process of assessing existing ICTs to decide whether they are still useful to an SME. This evaluation process takes place after the initial adoption, usage, appraisal and acceptance has occurred, and the existing ICTs have been in use for a while. The evaluation process then intends to investigate the usefulness or value of the current existing ICTs in an SME. Hence the evaluation in this study refers to a process that happens after post-adoption, post-acceptance, and post-usage processes.

Literature (Chiu, Chao, Kao, Pu and Huang, 2016; Mukred and Yusof, 2017; Aldholay, Isaac, Abdullah and Ramayah, 2018; Dang, Zhang and Chen, 2018) has shown that the ISSM has been successfully used to measure IS success. Originally, ISSM was developed to measure IS success. However, IS success is not necessarily equal to DT evaluation. Other researchers (Davis, 1989, 1993; Venkatesh, Morris, Davis and Davis, 2003; Deng, Turner, Gehling and Prince, 2010; Nhan and Chau, 2010; Baek, Park and Lee, 2011; Park, Kim and Lee, 2011; Al-hawari and Mouakket, 2012; Zhao and Cao, 2012) have developed numerous models to measure continued usage of IS and adoption of emerging DTs. These authors have equated continual usage to DT evaluation. Their argument is simply: if users keep on using the DTs then the 'DTs' are deemed effective. Although continual use of the DTs may result in their effectiveness, measuring continual use is not equivalent to evaluating the DTs. In some SMEs, the use of the DTs is mandatory (Venkatesh and Davis, 2000; Venkatesh *et al.*, 2003; Ambodo, Suryanto and Sofyani, 2017; Hwang, Chung, Shin and Lee, 2017; Bhattacherjee, Davis, Connolly and Hikmet, 2018; Kwahk, Ahn and Ryu, 2018), therefore, equating continual usage to effectiveness results in a distorted analysis. Hence, there is a very real need for a specific framework which can measure the

predictors of existing ICTs evaluation. Such a framework is likely to assist SME owners in informed decision-making.

Most of the academic debate on IS or ICT capital investment has concentrated on either the creation and critical study of appraisal and evaluation methods or post-investment evaluation (Lefley, 2013). Most of these studies have used IS success, adoption, use and acceptance models to appraise and evaluate DTs. Some of these models were meant to evaluate emerging DTs and not existing ICTs. This kind of evaluation was referred to appraisal (Lefley, 2013) or adoption (Carlsson, Carlsson, Hyvonen, Puhakainen and Walden, 2006; Park, Yang and Lehto, 2007; Rana *et al.*, 2016; Kurfalı *et al.*, 2017; Mokaya and Njuguna, 2017; Dang, Zhang and Chen, 2018; Park *et al.*, 2019). Appraisal / adoption is the process that takes place before a project's investment decision is made (Lefley, 2013). Some models that have been used successfully in the area of adoption/appraisal of a project before implementation include TAM (Davis, 1989); TPB (Ajzen, 1991); and UTAUT (Venkatesh *et al.*, 2003).

Most SMEs have only managed to evaluate the financial aspect of DT investments using financial evaluation models (FEMs) such as ROV, ROI, PBK, NPV, IRR, and ARR (Lefley, 2013; Chaysin, Daengdej and Tangjitprom, 2016; Maduekwe and Kamala, 2016). However, these models are not adequate for evaluating the non-financial aspect of existing ICTs, such as user friendliness, and ease and speed at which tasks are completed (Lefley, 2008; Maduekwe and Kamala, 2016). On the other hand, some SMEs do not experience financial constraints as a common impediment to their adoption of certain DTs (Themistocleous, Roseman, Loos, Buonanno, Faverio, Pigni, Ravarini, Sciuto and Tagliavini, 2005; Quartey *et al.*, 2017). For such SMEs, existing ICTs' evaluation, through financial models, becomes redundant, as said financial aspects of DTs do not constrain them.

Investment appraisal is the assessment of investments regarding their profitability and/or cost-effectiveness (Konstantin and Konstantin, 2018). FEMs have been used for the evaluation of DT investments (Saleem, Salim, Altalhi, Abdullah, Ullah, Baothman and Junejo, 2016), such that individual or a combination of methods have been used to evaluate the investment's return (De Jong, Ribbers and van der Zee,

1999; Fairchild, 2003; Nijland, 2003; Saleem *et al.*, 2016). FEMs were used as far back as 1965 (Rappaport, 1965); and over time, a variety of models has evolved. The most commonly used models are ARR, IRR, PBK, ROI, ROV, and NPV (Chaysin, Daengdej and Tangjitprom, 2016). The most popular of these is the PBK, which measures the risks associated with a project (Lefley, 1996, 2013; Chaysin, Daengdej and Tangjitprom, 2016; Fasoro and Ajewole, 2019). In telecommunication, PBK, IRR, and NPV are the most common investment efficiency indicators (Nekrasova, Leventsov and Axionova, 2016).

These financial approaches are insufficient to measure DT investments in other non-financial perspectives (Ballantine and Stray, 1999; Dadayan, 2006; Gustafsson, Huldt and Lofgren, 2009). As such, there is a need to develop an integrated framework that can evaluate the financial and non-financial value of DT investments; the current study purposed to accomplish such.

Although ROI is an easy and reliable appraisal method, there are some drawbacks to using it exclusively, such as its inability to account for investment timing and related returns (Schoukroun-Barnes, Duchars, Bartolowits and Sarno, 2019). As a result, most financial analyses use financial instruments such as NPV or IRR estimates to properly account for time in project evaluations. ROI has lost its popularity over time (Schatz and Bashroush, 2017); and this has paved the way for other methods such as NPV and PBK (Rappaport, 1965; Lefley, 1996; Milis, Snoeck and Haesen, 2009; Chaysin, Daengdej and Tangjitprom, 2016).

PBK's aim is to supplement profitability assessment models like NPV (Rappaport, 1965; Lefley, 1996). PBK has decreased in popularity, owing to its failure to consider the time value of money; this has paved the way for other, simpler methods such as NPV (Rappaport, 1965; Lefley, 1996; Milis, Snoeck and Haesen, 2009; Chaysin, Daengdej and Tangjitprom, 2016; Fasoro and Ajewole, 2019). However, as risks are common in DT projects, many organisations apply a multiple-method approach to projects (Chaysin, Daengdej and Tangjitprom, 2016; Saleem *et al.*, 2016). PBK is used for small-scale investments. Such is the case for SMEs, which are the focus of this study (Konstantin and Konstantin, 2018). Therefore, this study considers a

combination of NPV and PBK as the financial evaluation models to use. These two models are discussed in detail in the next chapter.

This study therefore sought to develop a framework that goes beyond the financial consideration of existing ICTs' evaluation, in that it also considers the non-financial factors. The non-financial factors include organisational, technological, social, and individual factors which drive the effective evaluation of existing ICTs. This framework is likely to be useful for most SMEs, whether they experience financial and/or non-financial factors as constraints. The framework purposes to cover a wide range of factors, both financial and non-financial, that affect the evaluation of existing ICTs.

2.7 Summary

The current chapter discussed the literature related to DTs (existing and emerging) and SMEs. It continued to detail how existing ICTs are being currently evaluated. This has led to the identification of the base model that informed this study. Potential models and frameworks that support evaluation of existing ICTs, were also identified.

The next chapter provides details of the factors relevant to the evaluation of existing ICTs. It explains how these factors are linked and integrated to form a theoretical framework. The study reviewed theories used in the area of adoption, usage, and acceptance of DTs; as well as financial evaluation models which evaluated the financial aspect of existing ICT investments. These models include: ISSM, TAM, TPB, UTAUT, ROV, NPV, IRR, ROI, ARR and PBK, respectively.

CHAPTER 3: THEORETICAL FOUNDATIONS

The previous chapters introduced the topic of the study, the research problem, research objectives, and the theoretical concepts of DTs and SMEs in the context of the 4IR, the usage, adoption, acceptance, and financial models that are currently being used by SMEs in evaluating DTs. Chapter 3 presented a concurrent, detailed review of usage, adoption, and acceptance models, comparing the factors that can be used to evaluate existing ICTs. The chapter concluded with the development of a conceptual framework which drove and directed this study.

3.1 Introduction

To address the research problem of the lack of an integrated framework for evaluating existing ICTs before adoption of emerging DTs, the study reviewed literature on usage, adoption, and acceptance of DTs. The study also reviewed financial models that have been used in the financial evaluation of DT investments. The established factors were used to develop the conceptual framework, which underpinned this research study. Research hypotheses, based on the conceptual framework, were formulated towards facilitating an understanding of how these factors influence one another in the evaluation of existing ICTs. ISSM being the base model, more non-financial factors were reviewed from UTAUT, TAM, and TPB. Financial factors were reviewed from PBK and NPV: these two models were found to be the most relevant. These models will be discussed in the subsequent sections.

3.2 DeLone and McLean's Information Systems Success Model (ISSM)

The ISSM was developed for the purpose of measuring IS success. Modifications were proposed (Pitt, Watson and Kavan, 1995; Seddon and Kiew, 1996; Jiang, Klein and Carr, 2002) which led to the development of an updated ISSM (Delone and McLean, 2003). The updated ISSM included the service quality factor; and replaced the *use* construct with *use* and *intention to use*. Figure 3.1 illustrates the updated ISSM.

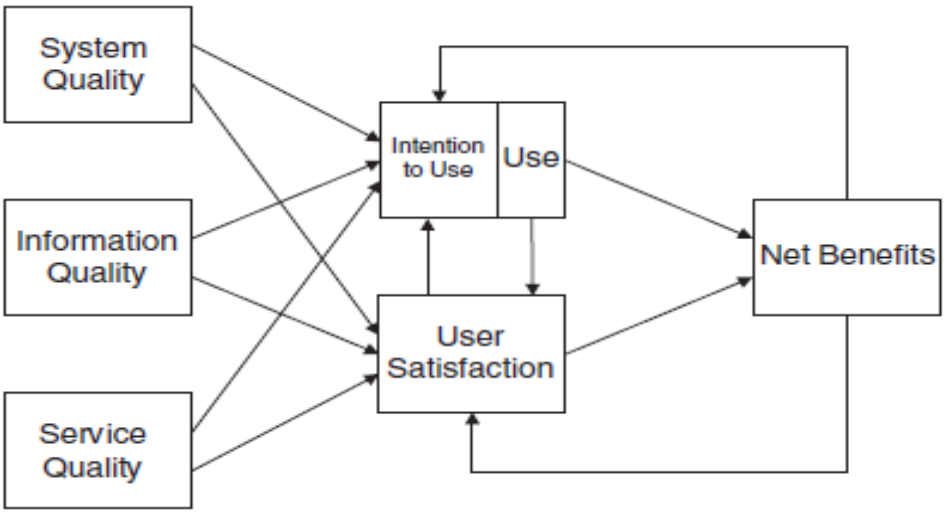

Figure 3.1: ISSM (Delone and McLean, 2003)

SME owner satisfaction, (intention to) use, system, service, and information quality, predicts net benefits of using DTs (Delone and McLean, 2003). Service, system, and information quality predict both (intention to) use and SME owner satisfaction, while (intention to) use and SME owner satisfaction predict or influence each other. SME owner satisfaction and (intention to) use results in either positive or negative benefits that will determine the continued use of DTs (Delone and McLean, 2003). If the SME owner does not benefit by the existing ICTs, the SME owner is likely going to abandon the existing ICTs for emerging DTs. However, if the SME owner benefits by the existing ICTs, the SME owner is likely to continue using them, neglecting or ignoring emerging DTs.

It should be noted that ISSM is silent about the environmental and social impact of existing ICTs on the SME owner. ISSM is also silent when it comes to the financial value of the existing ICTs for the SME and the owner. Many DT applications have underestimated the significance of the social context, while focusing more on the individual's task productivity (Lyytinen and Ngwenyama, 1992). This has resulted in ineffective application design, user problems, and the complete failure of numerous applications. ISSM is not exclusive in this situation. ISSM measures IT success in terms of SME owner satisfaction, excluding other facets of IT such as network, applications, hardware, and social context. As a consequence, some essential factors

that affect the successful evaluation of existing ICTs are absent from ISSM. The current research attempted to fill this gap.

The ultimate indication of whether existing ICTs are still worthwhile lies with the daily user. It is therefore vital to explore the perceptions of SME owners about evaluating existing ICTs. People, organisations, and society need to look at DTs in the context of their use: it is therefore impossible to understand DT in isolation (Roode, 1993; Geisler, 2002). Existing ICTs are defined and evaluated by potential users and their actual use (Roode, 1993; Geisler, 2002). Evaluation of existing ICTs thus depends, among other factors, on the characteristics and perceptions of the SME owner.

In support of the ISSM, many studies (Davis, 1989; Ajzen, 1991; Venkatesh *et al.*, 2003; Almarashdeh, 2016; Costa, Ferreira, Bento and Aparicio, 2016; Isaac, Abdullah, Ramayah and Mutahar, 2017, 2018) have been conducted on what drives user satisfaction in DT use. User behaviour was measured as a precursor to continued utilisation of existing ICTs. The studies equated behaviour with acceptance, usage, or adoption. However, others (Bokhari, 2005; Masrek, Abdul Karim and Hussein, 2007; Cornacchia, Papa, Livi, Sapio, Nicolò and Bruno, 2008; Trimmer, Beachboard, Wiggins and Woodhouse, 2008; Ling, Downe, Ahmad and Lai, 2011; Kalema, 2013a; Cheah *et al.*, 2014; Nirban, 2014; Khosravi and Ghapanchi, 2016; Yu, 2019; Peñarroja, Sánchez, Gamero, Orengo and Zornoza, 2019) have assessed user behaviour in relation to the effectiveness or efficient use of existing ICTs.

ISSM metrics were defined as follows::

a. **System quality** is a description of a DT's features or characteristics. Ease of use, sophistication, system flexibility, ease of learning, response times, system reliability, and flexibility are examples of these features. System quality defines the feautures or characteristics of a DT such as the quality of the hardware, software, and database; hence incorporated into the technological characteristics construct.
b. **Information quality** refers to the features or characteristics of the outputs from the DT. Outputs such as consolidated reports or dashboards. Information

quality attributes are: understandability, completeness, timeliness, accuracy, currency, conciseness, relevance, and usability. Information has been defined as a component of a DT, hence incorporated into the technological characteristics' construct.

c. **Service quality** refers to the quality of the support given to users by the IT department. Service quality can be measured by the following: reliability responsiveness, technical competence, accuracy, and empathy of the personnel. Service quality will be termed organisational factors in this study, as it refers to the existence of certain technical and organisational conditions that help facilitate the use of the DTs (Magsamen-Conrad, Upadhyaya, Joa and Dowd, 2015).

d. **Intention to use** DTs describe the attitudes toward the technology. This construct is in line with the behavioural intention to use, as described by other researchers (Davis, 1989, 1993; Venkatesh and Davis, 2000; Venkatesh *et al.*, 2003). Intention to use determines either continued use or abandonment of the existing ICTs, and ultimate adoption of emerging DTs (Deng *et al.*, 2010; Nhan and Chau, 2010; Baek, Park and Lee, 2011; Al-hawari and Mouakket, 2012; Zhao and Cao, 2012; Almarashdeh, 2016; Costa *et al.*, 2016; Isaac *et al.*, 2017, 2018).

e. **System use** refers to how and to what degree end users use existing ICT capabilities. System use can be measured using the following attributes: amount of use, nature of use, appropriateness of use, frequency of use, extent of use, and purpose of use. Use is a behaviour, whereas the intention to use is an attitude. (DeLone and McLean, 2002; Delone and McLean, 2003). Other studies (Davis, 1989, 1993; Ajzen, 1991; Venkatesh and Davis, 2000; Venkatesh *et al.*, 2003) investigated behavioural intention to use, as a single variable. This study will adopt the single variable behavioural intention to use. Behavioural intentions to use predicts the user's actual behaviour (Davis, 1989, 1993; Ajzen, 1991; Venkatesh and Davis, 2000; Venkatesh *et al.*, 2003). However, this is only the case when investigating the adoption of emerging DTs. In the case of investigating existing ICTs that are already in use, behavioural intention to use becomes behavioural intention to continue using.

As a result, the satisfaction of SME owners and the evaluation of existing ICTs will be influenced by their behavioural intention to continue using them.

f. **User satisfaction** relates to level of users' satisfaction with the information (output) from and the performance of the existing ICTs. Behavioural intention to continue using and user satisfaction have a causation effect (Delone and McLean, 2003). This study hypothesises that satisfaction of SME owners will impact evaluation of existing ICTs. If the SME owner is still satisfied with the existing ICTs then there is a higher chance that they will not consider the emerging DTs. On the other hand, if they are not happy, the probability of them abandoning the existing ICTs and adopting the emerging DTs is high.
g. **Net benefits** measures individuals and organisations' success as expressed by the existing ICTs. Net benefits include: increased productivity, cost reductions, better decision-making, improved competitive advantage, improved sales, market efficiency, creation of jobs, consumer welfare, increased profits, and economic development

The next section will summarise in tabular format how the ISSM has been used by other studies.

3.2.1 Application of ISSM in other studies

Table 3.1 summarises some of the studies that adopted the ISSM.

Table 3.1: Application of ISSM in other studies

Authors	Frameworks reviewed jointly with ISSM	Purpose	Limitation
Yusof, Paul and Stergioulas (2006)	IT-Organisation Fit Model	Developing a conceptual framework for the assessment of health information systems	• The authors' framework was developed in the health-care context and can thus not be generalised to other environments, including SMEs. • No data was collected to test and/or validate the developed framework.
Yusof (2011)	IT-Organisation Fit Model	To validate the previous conceptual framework created	• The author claims that the model is applicable to non-health IS. There is a need for a proper empirical study to justify such a claim.
Bossen, Jensen and Udsen (2013)	None	Post-implementation evaluation of a comprehensive electronic health record	• The financial value of the DT, as assessed, was not considered. • The study evaluated a system immediately after its implementation, which is a limitation. It is difficult to obtain useful insights so early on.
Cho, Bae, Ryu, Kim, An and Chae (2015)	None	Evaluation of the performance of a newly implemented information system at three public hospitals in Korea	• The financial value of the DT, as assessed, was not considered. • The authors evaluated a DT that people were fairly new to; their experience with the system was limited.
Roky and Al Meriouh (2015)	None	Post-evaluation of an information system	• Failed to investigate the other DT components, such as software. • The ISSM measures IS success and not evaluation. Hence, the researchers equated IS success to evaluation.
Veeramootoo, Nunkoo and Dwivedi (2018)	Expectancy confirmation theory	To validate an integrated model of e-filing continuance usage	• The authors failed to validate or consider the financial value of the e-filing to Mauritius Revenue Authority.
Al-Hashimi and Aqleh (2018)	None	To measure the success of hospital information systems in Bahrain from the end users' perspectives	• The authors used a health-care institution as a case; different results might be obtained for SMEs.

Many studies, as seen in Table 3.1, have measured the success of existing ICTs. However, each work had its shortfalls, which this current study intended to cover. Some of the common shortfalls highlighted and explored were the failure of those studies to independently measure the significance of each individual technology component (such as hardware, software, and users) to the evaluation of the existing ICTs. This is considered a limitation (Orlikowski and Iacono, 2001). Another key common shortfall was the failure of previous studies to investigate the financial value of the existing ICTs, which this current study intended to investigate. The subsequent section details how the ISSM was contextualised for this current study, in an attempt to overcome the limitations identified in literature.

3.2.2 Application of the ISSM and other adoption models in the current study

Based on the definitions of the ISSM metrics, and how other researchers used them, in an effort to appreciate and acknowledge the independent DT components (Orlikowski and Iacono, 2001), this study proposed that the quality of information and the system describe the technological characteristics. System quality was broken down into independent system (digital technology) components such as hardware, software, databases, and network, that describes fully the technological characteritsics. SMEs might believe that they need to replace the entire DT by adopting emerging DTs when, in fact, only the the faulty component, such as network being slow, or a virus affecting the software, thus the software only, must be replaced. Replacing the faulty component in such scenarios is more viable than replacing the complete DT. This study therefore proposes to independently investigate and measure the components of the DT. Such a comprehensive enquiry (evaluation) may eventually lead to an informed decision. Proper components should be in place for better and increased job performance (David and Rahim, 2012).

In this study, we forecasted that technological characteristics would impact user experience with existing ICTs. This experience is termed performance and effort

experience. Certain adoption studies have measured effort and performance expectancy towards a DT that users have not yet used, and do not have experience of (Davis, 1989; Thompson, Higgins and Howell, 1991; Venkatesh *et al.*, 2003; Yueh, Huang and Chang, 2015; Abraham, Junglas, Watson and Boudreau, 2016; Oliveira, Thomas, Baptista and Campos, 2016; Dwivedi, Rana, Janssen, Lal, Williams and Clement, 2017; Woldeyohannes and Ngwenyama, 2017; Bouznif, 2018; Choi, Wang and Sparks, 2019). This study looked at the experience that users have garnered with use of the existing ICTs, hence effort and performance expectancy from adoption studies (Davis, 1989; Venkatesh *et al.*, 2003) were termed effort and performance experience. This study investigated whether DT characteristics will influence both effort and performance experience. This is in the sense that, if the efficiency of the individual component has deteriorated, this will result in poor performance experienced by users, as well as a high demand in effort required of the user for the DT component/s. This led to the construction of Hypotheses 1 and 2 together with their null hypothesis. It is important to note that H1 and H2 were broken down into independent ICT components hypothesis with the labels H1a-H1f and H2a-H2f.

H1: Technological characteristics will influence effort experience with the existing ICTs.
$H1_o$: Technological characteristics will not influence effort experience with the existing ICTs.

H2: Technological characteristics will influence performance experience with the existing ICTs.
$H2_o$: Technological characteristics will not influence performance experience with the existing ICTs.

User satisfaction studies discovered that effort and performance experience will influence user satisfaction (Mahmood, Burn, Gemoets and Jacquez, 2000; Bhattacherjee, 2001; Kaewkitipong, Chen and Ractham, 2016). Low effort experience increases user satisfaction. The easier it is to use the DT, the more likely it is that the user will be satisfied,

and will continue to use the DT (Mahmood *et al.*, 2000; Bhattacherjee, 2001; Kaewkitipong, Chen and Ractham, 2016). Technology adoption studies investigated the role of effort and performance expectancy on behavioural intention to use (Davis, 1989; Thompson, Higgins and Howell, 1991; Venkatesh *et al.*, 2003; Yueh, Huang and Chang, 2015; Abraham *et al.*, 2016; Oliveira *et al.*, 2016; Dwivedi *et al.*, 2017; Woldeyohannes and Ngwenyama, 2017; Bouznif, 2018; Choi, Wang and Sparks, 2019). Furthermore, the proposition that effort and performance experience will influence user satisfaction is reinforced by user satisfaction studies (Mahmood *et al.*, 2000; Bhattacherjee, 2001; Kaewkitipong, Chen and Ractham, 2016). This led to formulation of Hypotheses 3, 4, 5, and 6, below;

H3: Effort experience will impact on user satisfaction with the existing ICTs.
$H3_o$: Effort experience will not impact on user satisfaction with the existing ICTs.

H4: Performance experience will impact on user satisfaction with the existing ICTs.
$H4_o$: Performance experience will not impact on user satisfaction with the existing ICTs.

H5: Effort experience will impact on behavioural intention to continue using the existing ICTs.
$H5_o$: Effort experience will not impact on behavioural intention to continue using the existing ICTs.

H6: Performance experience will impact on behavioural intention to continue using the existing ICTs.
$H6_o$: Performance experience will not impact on behavioural intention to continue using the existing ICTs.

The quality of service will be incorporated into organisational factors as it describes the role played by SMEs in supporting the use of existing ICTs. Users will intend to continue using existing ICTs that they believe will improve their job performance (David and Rahim,

2012; Ukut and Krairit, 2019). Therefore, SMEs should always make sure that the right infrastructure is in place to support or improve user experience (David and Rahim, 2012). Other studies termed organisational factors 'facilitating conditions' (Venkatesh *et al.*, 2003; Magsamen-Conrad *et al.*, 2015). These are characterised as a person's conviction that there is adequate technological and organisational infrastructure to enable the use of existing ICTs. The premise of this study is that organisational factors have a significant effect on the evaluation of existing ICTs. This proposition is anchored in the fact that facilitating conditions (organisational factors) have not been found to influence behavioural intention when there is performance and effort expectancy (Venkatesh *et al.*, 2003). This study investigated if that is the case where there is performance and effort experience. Therefore, the following hypothesis and null hypothesis were formulated:

H7: Organisational factors will directly influence evaluation of existing ICTs.
$H7_o$: Organisational factors will not influence evaluation of existing ICTs.

It is impossible to believe that an SME operates in isolation. Rather, every SME faces competition from other SMEs and bigger organisations, mostly within the same industry or environment. This competition is referred to as competitive pressure or turbulent environment (Teece, Pisano and Shuen, 1997; Wang and Ahmed, 2007). Thus, these pressures are applied to the everyday users of existing ICTs; and for SMEs, on the SME owner personally. The result is to force the SME owners to evaluate their existing ICTs; consequently abandoning or adopting emerging DTs. Environmental pressures refer to factors outside the SME which influence the SME's ability to function (Odhiambo, 2016) and these are competitive environment and support from external entities for the use of existing ICTs (Kim, Jang and Yang, 2017). When it comes to environmental factors, this study hypothesised that:

H8: Environmental factors will impact on organisational factors.
$H8_o$: Environmental factors will not have an impact on organisational factors.

ISSM literature announced that there is a cause-and-effect relationship between user satisfaction and behavioural intention to continue using. Furthermore, literature has suggested that behavioural intention to continue using and SME owner satisfaction will independently influence the evaluation of the existing ICTs (Bossen, Jensen and Udsen, 2013; Cho *et al.*, 2015; Roky and Al Meriouh, 2015). This study will investigate the same theory, in line with the evaluation of existing ICTs. Therefore:

H9: SME-owner satisfaction will influence behaviour to continue using the existing ICTs.
$H9_o$: SME-owner satisfaction will not influence behaviour to continue using the existing ICTs.

H10: SME-owner behaviour to continue using the existing ICTs will influence their consequent satisfaction with existing ICTs.
$H10_o$: SME-owner behaviour to continue using the existing ICTs will not influence their consequent satisfaction with existing ICTs.

H11: SME-owner satisfaction will influence the evaluation of the existing ICTs.
$H11_o$: SME-owner satisfaction will not influence the evaluation of the existing ICTs.

H12: SME-owner behaviour to continue using the existing ICTs will influence the evaluation of those ICTs.
$H12_o$: SME-owner behaviour to continue using the existing ICTs will not influence the evaluation of those ICTs.

3.3 Other Important Factors to Consider

It is impractical to investigate technology use without considering the social impact around its use (Lyytinen and Ngwenyama, 1992). Social influence is an extent to which an individual perceives that other people important to them believe they should use the existing ICTs (Venkatesh *et al.*, 2003). Even though referring to social influence as a

subjective norm, Ajzen (1991) defined social influence as an individual's perception of what other people think about their behaviour. These two definitions are of one accord. Any given significant other's opinion is weighted by the motivation that an individual must meet that significant other's wishes. Overall subjective standards may thus be expressed as a summary of human expectations and motivational evaluations for all applicable significant others. In mandatory settings (influenced at organisational level) the effect of subjective norms is noticeable, where other people's opinions matter more to the inexperienced than in voluntary settings (influenced at individual level) (Park, Yang and Lehto, 2007; Dečman, 2015; Wibowo, 2017; Kademeteme and Twinomurinzi, 2019a). Individuals are under peer pressure to obey explicit directives in obligatory environments. In voluntary environments, it is possible to determine what is needed (Kademeteme and Twinomurinzi, 2019a), however other studies have also found social influence playing a part in voluntary settings (Kademeteme and Twinomurinzi, 2019a). Subjective norm have been referred to as social factors (Thompson, Higgins and Howell, 1991) and social influence (Bandura, 1986; Venkatesh *et al.*, 2003; Park, Yang and Lehto, 2007). This study will use social factors as per Thompson, Higgins and Howell (1991)'s study.

It is important to understand the perspectives of significant others when evaluating existing ICTs. Significant others' views have little direct impact on the assessment of existing ICTs. They do, however, have an effect on people's attitudes. Social factors, according to the current study, will influence user behaviour, which will affect the evaluation of existing ICTs. Therefore, the following hypothesis was formulated:

H13: Social factors will impact on behavioural intention to continue using existing ICTs.
$H13_o$: Social factors will not impact on behavioural intention to continue using existing ICTs.

The next section will discuss financial evaluation models, and their role in the evaluation of existing ICTs.

3.4 Financial Evaluation Models (FEMs)

The following section discussed the PBK and NPV that the study found to be the most appropriate financial models for the evaluation of existing *ICT* investments.

3.4.1 Payback period (PBK)

PBK is a technique which computes or estimates the time period needed to return the initial investment costs, using the cash flow generated by the investment (Milis, Snoeck and Haesen, 2009). Projects which yield a quick payback are favoured, since projects are assessed according to the period needed to return the initial investment (Milis, Snoeck and Haesen, 2009). The payback period in the capital budgeting relates to the quantity of time required to recover an investments' cost. The time is calculated, in case of uneven cash flows (Konti, Papagiannakopoulou, Mamma, Kekos and Damigos, 2017). This is the length of time before the initial investment is recovered (Richard, Stewart and Alan, 2016). In the emerging DT adoption context, this means that the selection on which DTs to adopt, will be based on how quickly the emerging DTs yield results. DTs that deliver quick results are favoured. The shorter the payback period, the better the investment, as the investor/s will recoup their investment money in less time (Brigman and Cherry, 2002; Kharitonov and Kosterin, 2017).

This research study will calculate the payback period of existing ICTs. The payback period will influence the SME in either continuing to use existing ICTs or adopt emerging DTs. An SME would be interested in using DTs that have a shorter payback period (Brigman and Cherry, 2002; Kharitonov and Kosterin, 2017). Although acceptable as a general rule of thumb, PBK's limitations call for major investment choices to be based on more than the results of its calculations (Milis, Snoeck and Haesen, 2009). Therefore, a combined measure of PBK and NPV, with due consideration of the non-financial factors, will suffice to back up investment choices. The next subsection discusses NPV.

3.4.2 Net present value (NPV)

NPV is defined as the difference between a project's *value* and its *cost* (Richard, Stewart and Alan, 2016). Mathematically, NPV is essentially the difference between the discounted benefit and the discounted cost (Fasoro and Ajewole, 2019). Within the context of evaluating existing ICTs, NPV is the difference between the current value of the existing ICTs and its initial cost. SME owners would want to invest in any project that is worth more than its cost (Richard, Stewart and Alan, 2016). The final worth of NPV can be one of three possible values: zero, positive, or negative (Žižlavský, 2014). A zero value means that the existing ICT investment is no longer useful; a negative NPV means that the existing ICT investment is facing replacement; while a positive NPV value means that the existing ICT investment still has great potential to generate more cash inflow (Žižlavský, 2014). In short, a project with the highest positive NPV is generally seen as the most feasible and recommended (Fasoro and Ajewole, 2019).

In the context of this study the measure of NPV of the existing ICTs will influence organisational factors. A positive NPV would influence SME owners to continue using existing ICTs (Žižlavský, 2014; Kharitonov and Kosterin, 2017; Fasoro and Ajewole, 2019). A negative NPV, on the other hand, will urge SME owners to consider the adoption of emerging DTs (Žižlavský, 2014; Kharitonov and Kosterin, 2017; Fasoro and Ajewole, 2019). An NPV value of zero will *not* help clarify the SME owner's dilemma regarding the adoption of emerging DTs or the continued use of the existing ICTs. In their study the project's lifecycle was found to be 100 years, with an NPV value of zero; meaning that the cost of the project will be paid back only at the moment of completion of its lifecycle, which is 100 years (Kharitonov and Kosterin, 2017). SME owners would prefer that their initial investment not be returned over such a long period of time, but rather over a short period of time, as suggested by PBK (Brigham and Ehrhardt, 2005; Kharitonov and Kosterin, 2017).

3.4.3 Application of PBK and NPV in the current study

The financial assessment of existing ICTs will have a direct impact on the SME either to adopt emerging DTs, or to continue using existing ICTs. Therefore, this study hypothesised that:

H14: FEMs will impact on organisational factors.
$H14_o$: FEMs will not impact on organisational factors.

3.5 Conceptual Framework

The conceptual framework, as depicted in Figure 3.2, is based on the literature review and insights garnered from IS theories; as such, it underpins this research study. Figure 3.2 illustrates the conceptual framework.

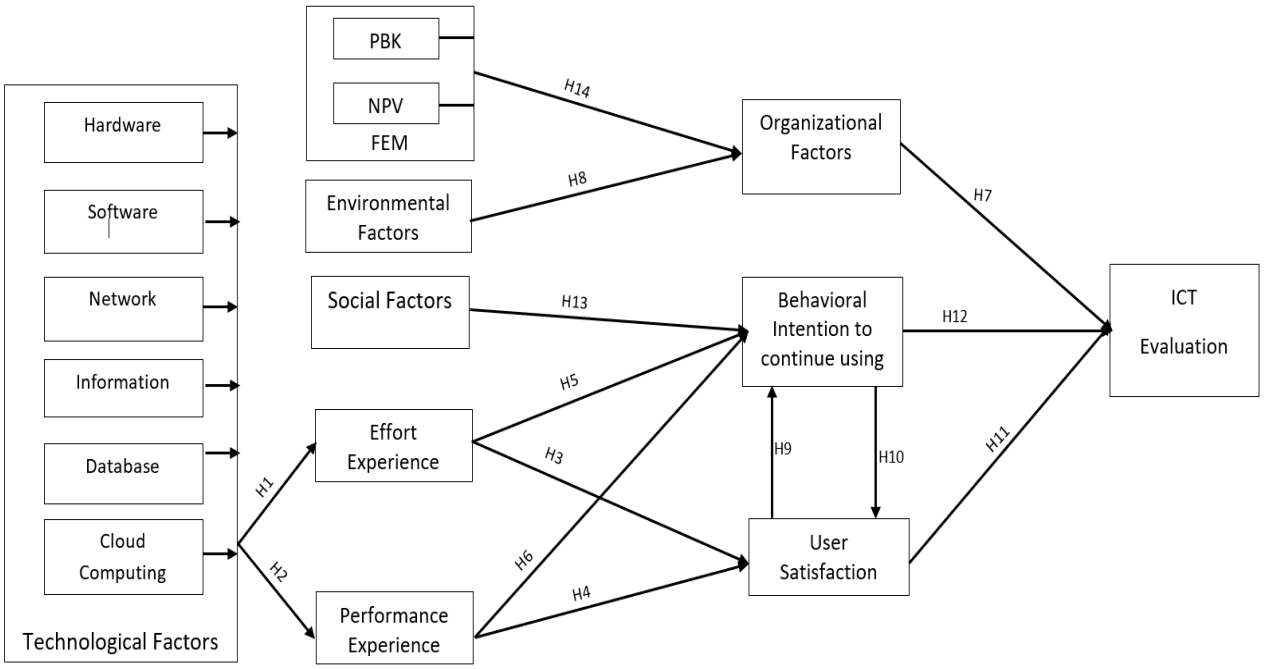

Figure 3.2: The conceptual framework for evaluation of existing ICTs

3.6 Summary

This chapter discussed in detail the theoretical frameworks and models which were used to inform the study. With support from technology adoption, acceptance and use models, the ISSM was used as the base model underpinning this study. The discussion steered the identification of influential factors in the evaluation of existing ICTs. In order to evaluate the financial aspect of the existing ICTs, the study reviewed a vast number of models, selecting the relevant ones that could be used. The identified factors and financial models were then triangulated, and structured into an integrated conceptual framework, which was, in turn, used to direct this study. The next chapter will detail the methodology followed to meet the objectives.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

Chapters 1 to 3 presented the research problem and objective of the study, literature relating to existing ICTs, emerging DTs and SMEs, as well as the theoretical foundations and conceptual framework which underpinned this study. Chapter 4 documents and provides a route towards achieving the major objective of this study by discussing the methodology in terms of paradigms, research approaches, research designs, and the philosophical assumptions which form the foundation of this research. Methods used to collect and analyse data are presented; and the chapter concludes with a discussion of issues relating to research ethics.

4.1. Research Design

Research design is a research plan which directs research activities: it facilitates the complex intersection of philosophy, strategies of enquiry, and specific methods (Clark, Creswell, Green and Shope, 2008). Research designs within quantitative, mixed methods, and qualitative design are enquiry types that provide a specific pathway to research-design procedures (Creswell, 2014). Research design is described as a framework for strategic action that serves as a link between research questions and their achievement, or the implementation of the research strategy (Blanche, Blanche, Durrheim and Painter, 2006). Research design can also be termed *strategies of enquiry* (Denzin and Lincoln, 2011). In an effort to direct this research study, the research-onion methodology approach, developed by Saunders, Lewis and Thornhill (2012), was adopted. Figure 4.1 illustrates an extract from the research-onion approach.

The research-onion approach is a research model that is useful in selecting the most suitable research methodology for any study. Six layers make up a complete research process (Saunders, Lewis and Thornhill, 2009, 2012). These layers, from the outside, are: philosophies, strategies, approaches, choices, procedures, techniques, and time horizons. Each layer contains several approaches from which one can choose, depending

on the nature of the study. Just like peeling an onion from the outermost layer to the inner layer, a researcher should select from the research onion the strategies that are applicable to their research study (Sahay, 2016).

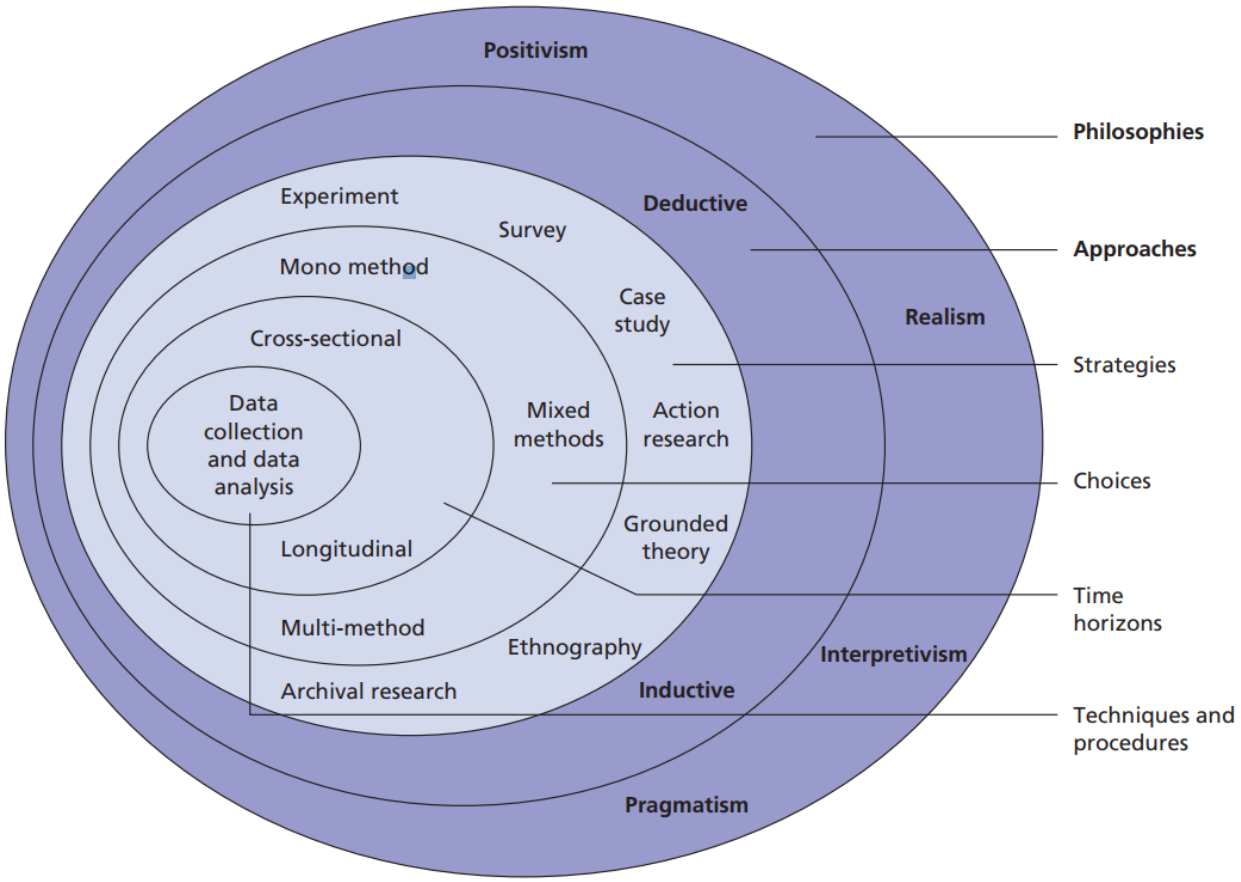

Figure 4.1: Research onion (Saunders, Lewis and Thornhill, 2012)

Within each layer, the researcher should explore and decide on the most suitable method, and one that complements the research study. These layers were discussed in detail to justify the choice of each approach.

4.2. Research Philosophies

The first external layer relates to the philosophical view of the study. A *research philosophy* focuses on the development of knowledge and its nature (Saunders, Lewis

and Thornhill, 2009, 2012). Figure 4.1 indicates the four types of philosophy which a study can follow, namely: interpretivism, positivism, pragmatism, and realism.

4.2.1 Positivism

Positivism measures the gap between *actual* knowledge and *accepted* knowledge (Saunders, Lewis and Thornhill, 2009, 2012). Researchers who adopt this philosophy are called *positivists*. A positivist frames and tests the research questions within the actual environment. Positivism explains a universal truth which under no circumstances can be changed. Positivism focuses on researching the cause-and-effect relationship between constructs (Sahay, 2016). Positivism aligns with the empiricist view that information emanates from humans as a result of their experiences (Collins, 2017). Positivism can be classified as a *scientific enquiry*; and therefore, statistical analysis plays a significant role in this research philosophy (Saunders, Lewis and Thornhill, 2009, 2012). To generate a research strategy for the collection of data within the context of positivism, the researcher will most likely develop hypotheses using existing theories, which will then be tested and either refuted or confirmed, in whole, or in part. This result will facilitate the development of the theory, which will, in turn, be tested and validated by that study, and by future studies (Saunders, Lewis and Thornhill, 2009).

4.2.2 Realism

Realism, as a philosophical approach, adheres to the same assumptions as positivism. As with positivism, realism is a philosophical lens which subscribes to scientific enquiry. Realism is an epistemological division, in that it assumes a scientific approach to knowledge development (Saunders, Lewis and Thornhill, 2009, 2012). Realism philosophy consist of two approaches: direct and critical. Direct realism reveals the world through human and personal senses, i.e., ‘you get what you see’, while critical realism argues that humans experience real-world sensations and images (Saunders, Lewis and Thornhill, 2009, 2012; Novikov and Novikov, 2013). Instead of seeing observable

phenomena as the totality of the real world, which positivists do, realism accepts that underlying phenomena are less observable forces (Payne and Payne, 2004). Realism assumes only that there is a social world outside of the researcher, accessible through sense and research (Payne and Payne, 2004). Another difference between positivism and realism is that theories are used in positivism to describe / predict phenomena, whereas the purpose of scientific realism is to represent the underlying real order that is only observed as phenomena. Thus, while realism, like positivism, is also phenomenological, realism is less fixated on the empirical evidence; that is, it does not define a theory's 'truth' as essentially its ability to predict accurately. Therefore, this study is more aligned to positivism than it is to realism

4.2.3 Interpretivism

Interpretivism focuses on understanding of the participant's mindset within the environment. Interpretivism advocates the need to comprehend differences amongst humans in their roles as social actors (Saunders, Lewis and Thornhill, 2009, 2012). An interpretivist tends to focus on the ways in which participants in a study are connected to one another; and how cultural existence affects their ideas and opinions. Interpretivism focuses not on *objects* (such as computers or machines), but on conducting research amongst *people* (Saunders, Lewis and Thornhill, 2009, 2012). The researcher, as a *social actor*, needs to appreciate the differences between people (Collis and Hussey, 2013). The mindset and attitudes of participants differ from the outset, and vary, in response to external environmental forces. Interpretivism requires researchers to interpret elements of the research study (Myers, 2013). Human interest thus forms an integral part of the interpretivist approach. Researches following the interpretive approach assume that reality can only be accessed and fully understood through social concepts such as shared meanings, consciousness, language, and research instruments (Myers, 2013). The criticism of positivism philosophy led to the development of an interpretivist philosophy (Saunders, Lewis and Thornhill, 2009, 2012; Myers, 2013). Interpretivism therefore favours the use of qualitative analysis over quantitative analysis. Interpretivist studies

focus on meaning; and may engage a multi-method approach in order to reveal various facets of the research problem (Saunders, Lewis and Thornhill, 2009, 2012; Myers, 2013). Interpretivism is not suitable for this study as the focus is on investigating objects such as ICTs which interpretivism does not focus on.

4.2.4 Pragmatism

Researchers who subscribe to this philosophy are termed *pragmatists*. Pragmatism is an approach that explains the existence of both objectivism and constructivism. The philosophical lens of pragmatism recognises that different ways of carrying out research and interpreting the world exist; and that no single viewpoint can encompass the whole image or facilitate multiple realities (Saunders, Lewis and Thornhill, 2009, 2012). The research question remains the most important determining factor in the choice of a research philosophy (Collis and Hussey, 2013). Pragmatists usually combine positivist and interpretivist philosophies within the scope of a research study, depending on the nature of the research questions (Saunders, Lewis and Thornhill, 2012). Therefore, pragmatism advocates for a mixed method approach where both qualitative and quantitative methods will be used in a single study.

Based on the discussions above, this study adopted *positivism* as a research philosophy. Positivism was regarded as a good fit for this study because a theory was developed from existing theories. Furthermore, from this newly developed theory, the study formulated hypotheses for testing which were used to validate the developed theory after analysis. The hypotheses resemble the *cause and effect* phenomenon which positivism aims to explore (Sahay, 2016). The research questions governing this study shed light on the development of a framework for SME owners to help in evaluating existing ICTs. The study used existing theories towards the development of the underpinning conceptual framework in accordance with the positivist approach. Positivist paradigm is purely based on factual evidence, and consider the world external and objective (Wilson, 2014). Therefore, subsequent processes will follow the requirements, as encapsulated by the

positivist paradigm. The other processes which are not associated with the positivist paradigm will therefore not be discussed in detail.

4.3. Research Approach

Figure 4.1 illustrates that a study can use either an *inductive* or *deductive* approach (Saunders, Lewis and Thornhill, 2009, 2012). The inductive approach advocates data collection first, and the theory development as a result of the data analysis. On the other hand, a deductive approach involves the development of a theory and hypothesis or hypothesis, and then the design of a research strategy that includes data collection to be analysed and evaluated (Saunders, Lewis and Thornhill, 2009, 2012; David and Lancaster, 2012). The positivist paradigm is reductionistic in essence, thus using a deductive-reasoning approach to solve problems (Creswell and Creswell, 2014). Positivist studies are usually associated with a *deductive* approach, which aims to validate the underlying theory by collecting data and empirically testing the set of hypothesis (David and Lancaster, 2012). Hence, this study followed a deductive research approach, in which the theory was first developed, followed by the formulation of a hypothesis. Consequently, data were collected to elucidate the hypotheses by means of statistical testing to see whether they would stand. Finally, the rejected hypotheses were removed from the final framework; whilst the accepted hypotheses remained, thus validating the framework.

4.4. Research Strategies

This layer of the research onion refers to the selection of appropriate research strategies which could prove helpful in identification of data-collection and analysis methods. The layer consists of the following strategies: survey, experiment, archival research, action research, case study, grounded theory, and ethnography (Saunders, Lewis and Thornhill, 2009, 2012). Of these strategies, grounded theory and ethnography require an inductive research approach (Saunders, Lewis and Thornhill, 2009, 2012). This study has settled for a deductive research approach; hence grounded theory and ethnography research

approaches will not be discussed. An archival research strategy enables research questions to be formulated that focus on the past and change with time, whether explanatory, descriptive or exploratory (Saunders, Lewis and Thornhill, 2009, 2012). This is not aligned with this study, hence archival research strategy will not be discussed in detail. Survey, experiment, and case-study research strategies are applicable in a deductive study. However, given the circumstances of this study, in that the study collected large volumes of data from South African SMEs, the study adopted the survey strategy, which facilitates such. The following section will justify why the survey was chosen over other strategies.

A survey strategy is applicable when one intends to gather a detailed understanding of the subject matter. Surveys are popular because they facilitate the highly cost-effective collection of large amounts of data from a large population (Saunders, Lewis and Thornhill, 2009, 2012). Data are often obtained using survey questionnaires, especially online survey questionnaires, that have a wider reach, and which can cater for a large population area at one time. Another advantage of a survey, is that the data collected are standardised, thus allowing for easy comparison.

The study intended to collect data from 300 SMEs operating in South Africa. This number was deemed substantial, which demanded use of instruments such as online surveys, it being difficult to visit these SMEs in person. In addition, a survey strategy is usually associated with the deductive approach, which tends to involve exploratory and descriptive research (Saunders, Lewis and Thornhill, 2009, 2012). When a researcher adopts the philosophy of positivism, he or she should keep minimal interaction with the research participants when conducting their research. One research strategy that facilitates data gathering with minimal interaction with the participants, is the survey strategy. Therefore, this study adopted and used the survey research strategy.

4.5. Research Choices

Research choices, the fourth layer in the research-onion model, refers to the nature of the study. The study can be categorised into three major elements, namely: qualitative, quantitative, or mixed methods. A researcher can choose to use either one of the elements, or both, in one study. Of these choices, a quantitative choice is associated with the positivism philosophy; hence the study adopted and used the quantitative option. The quantitative method is associated with data-collection methods or techniques such as questionnaires; and data-analysis procedures, such as statistics, which generate and use numerical data (Saunders, Lewis and Thornhill, 2009, 2012). The current study adopted a *mono method*, employing a *quantitative approach*. This choice was guided by the research philosophy, research approach, and research strategies.

4.6. Time Horizons

An important question which researchers need to ask themselves is whether they want to conduct a *snapshot* research, which is conducted at a particular time; or whether they want to collect *a series of snapshots*, which will represent events over a given period (Saunders, Lewis and Thornhill, 2009, 2012). A single snapshot time horizon is referred to as *cross-sectional*, whilst a series of snapshots is referred to as *longitudinal*. With a cross-sectional study, the researcher surveys the participants at one set time, while in a longitudinal study, the researcher surveys the participants several times over a longer period (Saunders, Lewis and Thornhill, 2009, 2012). Owing to time constraints, a cross-sectional study was identified as the appropriate choice for this study.

4.7. Techniques and Procedures

Layer six of the onion research model focuses on data collection and analysis tools. In this layer, the content related to the questionnaire, criteria of sample selection, and its

size, were discussed and decided upon. Techniques and procedures followed by this study are now discussed.

4.7.1 Population, sampling technique, and unit of analysis

Population

The population of this study was SMEs located in South Africa.

Sampling

A random sampling method was used to select participants from the population. Simple random sampling method was used due to its unbiased advantage in choosing participants (Bhattacherjee, 2012). The sample size was projected to be 300 SME owners. It was anticipated that 300 SME owners would suffice, because the method of analysis that this study intended to use required a minimum of 100 participants (Ding, Velicer and Harlow, 1995; Boomsma and Hoogland, 2001; Kline, 2005; Cangur and Ercan, 2015). The list obtained from Department of Small Business Development (DSBD) was in excel format, hence the random function [=RAND ()] was used to assign a random number against each SME. A filter was then used to extract the top 300 SMEs, thereby randomly selecting 300 SME owners.

With a university letter of ethical approval, the Department of Small Business Development was approached to obtain a list of active SMEs in South Africa. The researcher furnished the selected SME owners with the UNISA ethics clearance certificate, together with a request for their participation in the study. After agreeing to participant in the study, the researcher emailed the link with the online survey questionnaire to each SME owner. This email included an explanation of the online survey questionnaire, as well as a consent form to be completed, agreeing in advance to participation in the study.

Unit of analysis

SME owners were the unit of analysis for this study, because they possess knowledge of the cost of existing ICTs and emerging DTs. Furthermore, SME owners are responsible for making decisions within SMEs when it comes to adoption of emerging DTs (Negulescu, 2014; Enagi and Van Belle, 2019), or continued use of existing ICTs; hence it was seen fit to collect data from them.

4.7.2 Data-collection methods

An online survey questionnaire was used to gather data. The instrument was developed based on the constructs identified from literature. The closed-ended questionnaire was designed, in line with the way in which other researchers measured the adopted constructs − a process known as operationalisation. Therefore all factors were operationalised using research work by various authors. Table 4.1 summarises the literature used to operationalise each factor.

The study adopted the Likert scale of 5 points, in which 1 denoted ‘strongly agree’ and 5 denoted ‘strongly disagree’. A sample of the questionnaire can be viewed in Appendix C. The instrument was developed using Google Forms. The online survey is accessible on the following link: Online Survey Questionnaire. Owing to the complexity of the term *ICT* and the unknown level of technical expertise of the SME owners who participated in the study, the terms *mobile technology* and *computers* were used. However, the questionnaire clearly stated that the focus is on ICT however ICT can be equated to computers or mobile technologies like laptops. This was done for participants to understand what the term ICT meant.

Table 4.1: Operationalization of the Constructs

Factor in this study	**Original Construct**	**Model Derived from**	**Source**
User satisfaction	User satisfaction	ISSM	(Seddon and Kiew, 1996; Delone and McLean, 2003; Armstrong, Fogarty, Dingsdag, Dimbleby and Julian, 2005; Hellsten and Markova, 2006; Petter, DeLone and McLean, 2008; Tella, 2011; Zaied, 2012; Alshibly, 2014; Miss, 2014; Eldrandaly, Naguib and Hassan, 2015)
Behavioural intention to continue using	Behavioural intention to use	ISSM and UTAUT	(Davis, 1989; Ajzen, 1991; Seddon and Kiew, 1996; Venkatesh *et al.*, 2003; Delone and McLean, 2003; Armstrong *et al.*, 2005; Hellsten and Markova, 2006; Petter, DeLone and McLean, 2008; Tella, 2011; Zaied, 2012; Alshibly, 2014; Miss, 2014; Eldrandaly, Naguib and Hassan, 2015)
Technological factors	System quality, Information quality and facilitating conditions	ISSM and UTAUT	(Seddon and Kiew, 1996; Venkatesh *et al.*, 2003; Delone and McLean, 2003; Armstrong *et al.*, 2005; Hellsten and Markova, 2006; Brown, 2008; Petter, DeLone and McLean, 2008; Tella, 2011; Zaied, 2012; Alshibly, 2014; Miss, 2014; Eldrandaly, Naguib and Hassan, 2015; Alharbi, Atkins and Stanier, 2016; Alismaili, Li, Shen, He, 2016)
Effort experienced	Effort expectancy	UTAUT	(Davis, 1989; Venkatesh *et al.*, 2003)
Performance experienced	Performance expectancy	UTAUT	(Davis, 1989; Venkatesh *et al.*, 2003)
Social factors	Social Influence	UTAUT	(Venkatesh *et al.*, 2003)
Organisational factors	Facilitating conditions and service quality	ISSM and UTAUT	(Seddon and Kiew, 1996; Delone and McLean, 2003; Venkatesh *et al.*, 2003; Armstrong *et al.*, 2005; Hellsten and Markova, 2006; Petter, DeLone and McLean, 2008; Tella, 2011; Zaied, 2012; Alshibly, 2014; Miss, 2014; Eldrandaly, Naguib and Hassan, 2015)
Environmental factors		No model	(Teece, Pisano and Shuen, 1997; Zhou, Lu and Wang, 2010; Kaur and Mehta, 2016; Odhiambo, 2016; Kim, Jang and Yang, 2017)

4.7.3 Data Analysis

Statistical methods were used to analyse the collected data and, in so doing, provide empirical evidence. Since each factor consisted of a number of questions, a total for each construct was computed in SPSS. Descriptive and SEM statistics were then extracted based on the computed and recoded constructs. Cronbach's alpha was used to assess and test instrument reliability. A further analysis of the demographics of participants and situational variables was conducted, using frequency and descriptive statistics, respectively. After, the study conducted inferential statistics to estimate and draw conclusions. There are several inferential statistics from which a researcher can choose; the study used structural equation modelling (SEM).

SEM was utilised on the grounds that it offers the ability to accept that every factor influences every observed variable; and that the regular components are either all related, or uncorrelated. The study also did not intend to impose any substantive constraints on the data hence SEM was used (Barrett, 2007; Arbuckle, 2008, 2010; Albright and Park, 2009). Apart from the aforementioned capabilities, SEM offers the following advantages: it enables control of the measurement error; it facilitates simultaneous investigation of modelled path coefficients, and general consistency testing between the data and the hypothesised model; and it allows for more straightforward testing of the relationships between variables than in traditional methods such as regression analysis (Blanthorne, Allison Jones-Farmer and Dreike Almer, 2006; Mokwena, 2011).

SEM is applied sequentially in the following stages: development of individual constructs, development of the conceptual framework, designing a research study to yield empirical results, developing measurement model/s, testing and evaluating the measurement model/s with the collected data, structural model development, evaluating the validity of the structural model and, finally, extracting path values to evaluate both the unsupported and the supported hypotheses (Hair, Black, Babin, Anderson and Tatham, 2006). This

study followed these stages in line with existing ICTs. The following section details the SEM procedure.

4.7.3.1 SEM procedure

In order to conduct SEM analysis, version 22 of statistical package for social sciences (SPSS), and Analysis of MOment Structures (AMOS) graphics were applied to draw the measurement model, using the gathered data. The research study followed the steps described by Arbuckle (2008, 2010). SEM comprises a measurement model and a structural model (Ullman, Bentler, Hardy and Bryman, 2004; Schreiber, 2008). A measurement model is also known as *confirmatory factor* analysis (CFA) (Ullman *et al.*, 2004; Schreiber, 2008). Such analysis postulates the rules governing the way in which constructs, or latent variables, are measured in terms of construct items or observed variables (Ho, 2006; Schreiber, 2008). A structural model is an extensive model which stipulates a relationship pattern between independent and dependent variables. A structural model also displays the connection of the hypothesised relationships with the constructs, thus explaining the direct and indirect effects amongst constructs and construct items (Blanthorne, Allison Jones-Farmer and Dreike Almer, 2006). In SEM, *constructs* are referred to as latent, silent, or unobserved variables, while *construct items* are referred to as observed variables.

Latent variables are those constructs, or factors, that cannot be measured directly, hence they are referred to as *unobserved variables*. These variables are therefore measured *indirectly* by measuring their respective indicators, or items. In a measurement, or structural model, *oval shapes* represent latent variables; while observable variables, or construct items, are represented by *rectangular shapes*. Two-headed arrows are used to connect latent variables to each other. Such double-headed arrows represent a covariance between two latent variables. Latent variables and observable variables are connected to each other by a single-headed arrow. The line which is single arrowhead

represents the causal path from the latent variable (construct) to the observable variable (indicator or construct item).

An error term should be attached to each indicator (observed variable) because latent variable scores may disagree, hence these error terms represent measurement errors (Arbuckle, 2008). Each error term was labelled with a combination of the letter ‘e’ and an integer value, in that order. Each error term was uniquely labelled.

The determination of whether a specified model has been identified is a vital step in CFA (Arbuckle, 2008). An unidentified model is one for which unique estimates of parameters are hard to derive (Hoyle, 2012). Therefore, to identify the model, the metrics of the latent variables had to be set. There are two common methods used to make the model identifiable: *either* set the variance of one of its factor loadings; *or* set the variance of the latent variables to a value of one (1) (Arbuckle, 2010). This study adopted and used the method of setting the variance of one of its latent variables to a value one.

After development, the measurement model was run using the working file and outputs extracted from AMOS. It was essential to evaluate whether a model ‘fitted’ the data in SEM. There are several methods or techniques that can be used to assess model fitness. Methods fall into the following categories: incremental fit indices, absolute fit indices, and parsimony fit indices (Hooper, Coughlan and Mullen, 2008). Some of the common techniques, and their respective categories, are listed in Table 4.2.

Table 4.2: Summary of Categories of Indices and their respective Fit Indices

Category	Parsimony Fit Indices	Incremental Fit Indices	Absolute Fit Indices
1.	Parsimony goodness-of-fit index (PGFI)	Normed-fit index (NFI)	Model chi-square (χ^2)
2.	Parsimonious normed fit index (PNFI)	CFI (Comparative fit index)	Root mean square error of approximation (RMSEA)
3.	Akaike information criterion (AIC)	Non-normed fit index (NNFI	Goodness-of-fit statistic (GFI)
4.	Consistent version of AIC (CAIC)		The adjusted goodness-of-fit statistic (AGFI)
5.			Root mean square residual (RMR)
6.			Standardised root mean square residual (SRMR)

Owing to the abundance of fit indices available to the researcher and the wide disparity in agreement as to which indices fit to report and what the threshold values are for different indices, it is conceivable that the conflicting information could overwhelm the researcher (Hooper, Coughlan and Mullen, 2008). It is therefore unnecessary, or unrealistic, to report every fit index obtained from AMOS output, as such will burden both the reviewer and the reader (Hooper, Coughlan and Mullen, 2008).

A single research study should report on at least three index types, given that the important and mandatory CFI, RMSEA, and χ^2 are included (Kline, 2005). The most frequently reported fit indices are the NNFI, GFI, CFI, and NFI (McDonald and Ho, 2002). This research study used the Chi-square, the RMSEA, the SRMR, the CFI, and PNFI. This study chose these fit indices over others because these fit indices are not too sensitive to model misspecification, sample size, and parameter estimates (Hooper, Coughlan and Mullen, 2008).

The threshold values of the selected indices, listed in Table 4.3, were suggested by various authors. This study extracted fit indices from the AMOS output, analysing them against the threshold values, as listed in Table 4.3.

Table 4.3: Model Fit Indices and their Threshold Values

Measurement Model Fit Indices	Acceptable Threshold Levels	Source
χ^2	Between 2.1 and 3.1	2:1 (Tabachnik and Fidell, 2007) 3:1 (Kline, 2005)
RMSEA	Below 0.07	(Hu and Bentler, 1999; Steiger, 2007)
SRMR	Below 0.08	(Byrne, 1998, 2016; Hu and Bentler, 1999; Diamantopoulos and Siguaw, 2000)
CFI	Greater than 0.95	(Bentler, 1990; Hu and Bentler, 1999)
PNFI	Greater than 0.50	(Mulaik, James, Van Alstine, Bennett, Lind and Stilwell, 1989)

Fit indices within the threshold ranges show that the model is a good fit and thus requires no further modification. However, fit index values which fall outside the range show that the model requires further modification. Owing to the complexities presented by SEM, it is quite common to discover that the proposed model fits the data poorly, and therefore requires further modification of the measurement model to obtain precise results (Kline, 2005; Hooper, Coughlan and Mullen, 2008). A measurement model is modified by identifying and modifying, or removing, the construct items or indicators that are out of range, or that are resulting in a distorted value of the measurement model.

Jöreskog and Sörbom (1993) suggested the following steps when trying to identify which indicators to delete or modify in a measurement model:

a. Regression weights must be between 0.5 and 0.7.
b. A squared multiple correlation threshold value of 0.5 should be achieved.
c. Delete modification indices that have high covariance and regression weights.

Subsequently, after modifying the measurement model and running it once again, fit indices were extracted from the AMOS, comparing the values against the threshold in Table 4.3. Should the fit indices be out of range, further modification would be warranted until the model fitted the data. Finally, after fitting the data, the study constructed the final refined model, excluding all indicators that were suggested for elimination.

In an effort to identify the supported, or rejected, hypotheses, the study extracted AMOS output of the refined model with factor loadings. The output reflects the standardised significance levels that showed the hypothesised relationships between the constructs forming the underpinning framework for evaluation of existing ICTs. When it comes to determining the significance of a hypothesised relationship, a critical ratio (CR) value greater than +1.96 or less than -1.96 should be obtained (Hair *et al.*, 2006).

4.8. Ethical Considerations

This study observed all ethical issues in all its phases. The study followed ethical guidelines suggested by ethics studies (Israel and Hay, 2006; Hesse-Biber, 2011) and the university. Participants were assured that all information collected via the questionnaires would be treated as private, personal, and confidential. Participants were also informed that participation in the study was completely voluntary. Any participant who decided not to participate further, could simply not fill the questionnaire, or disagree to the consent. No names were asked for in the questionnaire; hence all responses were anonymous and reported as such in the findings. The researcher further assured the participants that participating in this study would not result in any foreseeable emotional discomfort or inconvenience, to them or their families. The researcher further affirmed that the results of the questionnaire would be for academic purposes only, towards development of a framework that could help in evaluation of existing ICTs: the study delivered on this assurance.

Taking part in this study was thus entirely *anonymous* and *voluntary*, and the participants were entitled to withdraw and retire from participating at any time. The participants did not have to provide any motivation for withdrawal. All responses were and still are stored in a Google Drive location in the Cloud. Responses will be preserved for five years, after which they will be deleted. The Google Drive is only accessible through the researcher's email; thus he alone will be able to access the responses. The questionnaire was approved by the ethics committee of the university. The letter of approval to collect data,

the ethics to be followed and the consent forms are attached in Appendix A, B, and C respectively. The consent form formed the introductory part of the questionnaire. The online survey questionnaire was designed in such a way that it was mandatory for participants to give consent before participating in the study. Failure to give consent would not allow them to continue participating.

4.9 Main Survey

Owing to difficulties and challenges faced in engaging SME owners, the study managed to collect data from only 240 respondents instead of the 300 anticipated. Of the 240, only 222 could be used for analysis. Some participants decided against participating in the study; and others gave incorrect information in certain fields. Such responses were excluded from the final analysis. Table 4.4 records the questionnaire dissemination and participation rate. The questionnaire was coded into SPSS.

Table 4.4: Questionnaire Dissemination and Participation Rate

	Reaction	**Consent**	**Questionnaires Usable**	**Usable/Unusable Rate (%)**
Engaged: 300	Accepted: 240	Agreed: 226	Usable: 222	98.3%
			Spoiled: 4	1.7%
		Disagreed: 14		
	Rejected: 27			

4.10 Reliability Analysis

Before commencing the actual data analysis, the survey questionnaire was tested for reliability. Reliability was used to determine the confidentiality and correctness of the research tool and the constructs (Pallant, 2020). Any research instrument should yield the same result if used at different times or by different people (Roberts, Priest and Traynor, 2006). For a research to be termed *reliable*, reliability must score above 0.7 (Pallant, 2020). A reliability of 0.75 means that 75% of the observed score variability is

true and 25% is erroneous. Therefore, it is highly recommended that the study uses constructs that demonstrate higher reliability; however, such values are not easy to obtain.

The Cronbach's alpha (α) or alpha coefficient was used to test both the survey questionnaire and the constructs for reliability. Cronbach's alpha coefficient is a statistical method used to test items for internal consistency. Cronbach's (1951) alpha is mathematically defined as:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

where α = Cronbach's alpha coefficient

K = number of Sample Items,

$\sigma_{Y_i}^2$ = is the variance of component *i* for the current sample of persons; and

σ_X^2 is the variance of the total test scores observed

The instrument used in this study had an α-coefficient value of 0.893 as obtained from SPSS with 85 items, as shown in Table 4.5. This α-coefficient value is above 0.7, which is the required minimum value (Pallant, 2020). The survey questionnaire used in this study has therefore been deemed reliable. The questionnaire consisted of 94 items; however, some of the items were not used in computing the reliability statistics because of their difference in the scale, or nature, of coding. The 85 items used in the coding were based on the Likert scale, while the other 9 items which include year of existing ICT purchase, anticipated income, cost of acquiring new ICT, etc., were *not* based on the Likert scale. Including them in the computation of the reliability statistics would have resulted in a distorted value.

Table 4.5: Reliability Estimates of the Research Instrument

Cronbach's Alpha coefficient	Cronbach's Alpha coefficient Based on Standardised Items	Number of Items
.893	.939	85

The study further analysed the reliability of each construct included in the research instrument. Table 4.6 presents an extract from SPSS and the code used for each construct in SPSS; henceforth, these codes will be used in reporting. As summarised in Table 4.6, 14 constructs had their reliability measured; three constructs (Inf, Nw and Db) had values less than the minimum threshold of 0.70. Their values were 0.566, 0.493, and 0.559, respectively. The reliability of EF and OE were found to be 0.673, and 0.65, respectively, values that are below the minimum threshold of 0.70; however, when rounded off to 1 decimal place, both of their values became 0.7; which is exactly equal to the minimum threshold. The rest of the constructs (Hw, Sw, Cc, EE, PE, SF, OF, BI, and US had the following reliability values; 0.715, 0.769, 0.724, 0.812, 0.886, 0.704, 0.813, 0.850, and 0.893, respectively, which were all above the minimum threshold of 0.70 (Pallant, 2020), hence were deemed reliable.

As some constructs failed to meet the minimum reliability threshold, the study had to conduct a further reliability analysis; which includes extracting the item-total statistics. The item-total statistics table shows the change in reliability of the constructs when one of the construct items is removed from the reliability computation (Pallant, 2020). This will lead to the exclusion of construct item/s, causing the reliability value to be below 0.7.

Table 4.6: Constructs' Reliability Statistics

Construct	Cronbach's Alpha coefficient	Cronbach's Alpha coefficient Based on Standardised Items	Number of Items
Hardware (Hw)	0.717	0.715	4
Software (Sw)	0.761	0.769	4
Information (Inf)	0.535	0.566	5
Network (Nw)	0.472	0.493	4
Database (Db)	0.569	0.559	4
Cloud computing (Cc)	0.722	0.724	6
Effort experienced (EE)	0.812	0.812	4
Performance experienced (PE)	0.877	0.886	5
Social factors (SF)	0.718	0.704	4
Environmental factors (EF)	0.653	0.673	4
Organisational factors (OF)	0.804	0.813	6
Behavioural intention to continue using (BI)	0.846	0.850	3
User satisfaction (US)	0.891	0.893	4
Overall evaluation (OE)	0.588	0.647	6

Table 4.7 records the item-total statistics of each construct item of the three constructs that fell out of range. The 'Cronbach's Alpha coefficient if Item Deleted' column shows the reliability value when that construct item is deleted. Consider, for example, the construct Nw: if item Nw4 were deleted, the reliability of the construct would improve from 0.493 to 0.568. Of all the construct items in Table 4.7, only OE4 will improve the reliability of OE when deleted, taking the value from the initial 0.647 to 0.732. The rest of the construct items will not significantly improve the reliability of the construct when deleted, therefore none were deleted. Constructs which do not meet the minimum threshold, as suggested by researchers, should be discarded, and not be considered for further analysis.

However, in this study, we decided to consider such constructs for subsequent statistical analysis. This was so that, when conducting SEM, during measurement model modification, deletion preference would be given to such constructs that had the lowest Cronbach's alpha (α) values. Furthermore, since all constructs collectively resulted in a highly reliable instrument the study opted to continue with all the constructs.

Table 4.7: Item-Total Statistics

Construct	Construct Item	Cronbach's Alpha coefficient if Item Deleted
Inf	Inf1	.475
	Inf2	.412
	Inf3	.430
	Inf4	.513
	Inf5	.563
Nw	Nw1	.375
	Nw2	.366
	Nw3	.274
	Nw4	.568
Db	Db1	.521
	Db2	.311
	Db3	.522
	Db4	.575
OE	OE1	.535
	OE2	.463
	OE3	.446
	OE4	.732
	OE5	.488
	OE6	.551

4.11 Summary

This chapter outlined the methodology followed to meet the goal of the study. The chapter thus explained data-preparation processes before the main data analysis was conducted. The chapter detailed the main survey for the study, which included statistics of how many participants were approached, and how many responses were used in the final analysis

of data. This process formed part of data cleaning; as the researcher had to discard some questionnaires that had not been correctly completed. Finally, Cronbach's alpha (α) coefficient was computed to test the reliability of the instrument. The next chapter presents an analysis of the collected data.

CHAPTER 5: DATA ANALYSIS

Chapters 1 to 4 discussed the research problem and objective of the study, literature relating to ICTs, emerging DTs and SMEs, the theoretical foundations, and the conceptual framework which underpinned this study; as well as the methodology followed to address the research problem. The analysis and discussion of the results obtained from the research study is presented in this chapter. The chapter comprises the following sections: frequency of demographics of participants, descriptive statistics, and CFA. CFA and SEM are used to develop the measurement model, and validation of the developed model, respectively.

5.1. Demographics of Participants

Demographics of participants include factors such as gender, age group, and level of education.

5.1.1 Gender

Figure 5.1 illustrates the frequency statistics for gender.

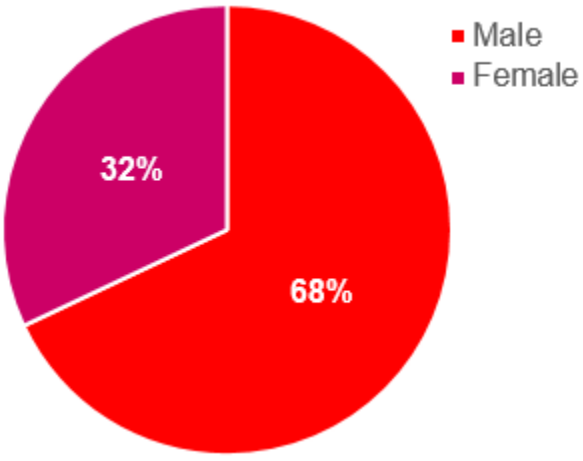

Figure 5.1: Gender frequency in percentages

The pie chart in Figure 5.1 shows more males (68%) than females (32%) participated in the research sample. In any particular study it is difficult to have an equal representation of males and females; and so these figures are considered acceptable. However, these figures might suggest that the majority of SME owners are males, not only in the study sample, but most likely in South Africa. However, this is yet to be verified, and is not the objective of this study.

5.1.2 Age group

The study investigated the participants' age by asking the participants to indicate their age. The SPSS was then used to re-code and group the ages of the participants according to different age groups. The following groupings were used: under 31; between 31 and 35; between 36 and 40; and over 40. Table 5.1 shows the age frequency table, as taken from SPSS.

Table 5.1: Age-group Frequency

Age Group	Frequency	Per cent	Cumulative Per cent
Under 31	58	26.1	26.1
31 - 35	75	33.8	59.9
36 - 40	71	32.0	91.9
Over 40	18	8.1	100.0
Total	222	100.0	

As shown in Table 5.1, the 31 - 35 and 36 - 40 age groups had the highest representation of 33.8% and 32.0%, respectively. This was followed by under 31, which in this study accounted for 26.1% of the sample. Also participating in this study were a few individuals, over 40 years. These results suggest that South Africa's majority of SMEs are owned and operated by the middle-aged and the young. It may also be that their older counterparts were unwilling to spend 15 to 20 minutes of their day participating in such an online study.

While it could be daunting for anyone 41 or older to complete a questionnaire, the fact remains that the majority of technology users are young people, generally under the age of 40 (Kalema, 2013b). Therefore the age analysis result obtained in this study is justifiable. This result is consistent with the findings of other studies on the use and acceptance of technology (Venkatesh *et al.*, 2003; Sun and Zhang, 2006). However, in other recent studies (Kademeteme and Twinomurinzi, 2019b) age was found not to play a part in circumstances of technology evaluation.

5.1.3 Level of education

Participants were asked to indicate their level of education by selecting from the following options: matric/certificate, diploma, degree, and postgraduate. The results are indicated in Table 5.2.

Table 5.2: Level of Education Frequency

Education level	Frequency	Per cent	Cumulative Per cent
Matric/Certificate	60	27.0	27.0
Diploma	98	44.1	71.2
Degree	36	16.2	87.4
Postgraduate	28	12.6	100.0
Total	222	100.0	

The results show that only 12.6% of the participants in the study held postgraduate qualifications − such was the least represented of all. This was followed by ‘degree’ which 16.2% of the participants indicated that they possessed. A total of 27.0% of the SME owners indicated that they held at least a matric/certificate − this group was the second-most represented. The best-represented group was ‘diploma’ − 44.1% of the participants. Considering the cumulative frequency, the results show that 71.2% of the participants hold at least a diploma qualification, with the majority (44.1%) of participants having indicated they hold at most a ‘diploma’.

5.2. Participants' experiences

This section represents the experience and knowledge of the respondents with respect to the use of ICTs in general, and the type of ICTs they used in their organisation at that specific time. Table 5.3 indicates the statistics for frequencies extracted from SPSS.

Table 5.3: Frequency of Participants' Experiences

Factor	Scale	Frequency	Per cent	Cumulative Per cent
Knowledge of using mobile technology	No knowledge	6	2.7	2.7
	Weak	4	1.8	4.5
	Average	62	27.9	32.4
	Good	77	34.7	67.1
	Excellent	73	32.9	100.0
	Total	222	100.0	
Knowledge of using desktop computers	Weak	5	2.3	2.3
	Average	16	7.2	9.5
	Good	40	18.0	27.5
	Excellent	161	72.5	100.0
	Total	222	100.0	
SME year commencement group	SMECommYear <= 3	50	22.5	22.5
	4 >= SMECommYear <= 6	35	15.8	38.3
	7 >= SMECommYear <= 9	46	20.7	59.0
	10 >= SMECommYear <= 12	32	14.4	73.4
	13 >= SMECommYear <= 15	37	16.7	90.1
	SMECommYear >= 16	22	9.9	100.0
	Total	222	100.0	
Type of current technology	Mobile	102	45.9	45.9
	Computers	120	54.1	100.0
	Total	222	100.0	

Studies have found that factors such as knowledge and experience of a participant have an effect on intention (Fishbein and Ajzen, 1975; Taylor and Todd, 1995). Experienced SME owners are more likely to continue to use ICTs with which they have experienced

and are comfortable than to start learning new emerging DTs. The results, as per Table 5.3, show that a combined high number of participants in this study (95.5% of the sample) have knowledge of the use of mobile technology ranging from average to excellent; while only 4.5% of the participants have below average knowledge. Apart from mobile technology, the study also investigated participants' experience with desktop computers. The results, recorded in Table 5.3, show that most of the participants (90.5%) have either a good or excellent knowledge of using desktop computers. A lower number of the participants (9.5%) in this study indicated 'below average' when it comes to knowledge of using desktop computers. Therefore, it can be concluded that the participants in this study are knowledgeable when it comes to use of technology.

These results imply that SME owners who are knowledgeable regarding the use of a certain technology, know *how* the technology should behave when it is being used. This enables them to realise and recognise the need for change. These individuals will thus know when it is necessary to replace existing ICTs, or whether they should continue using the existing ICTs, if the behaviour of said ICTs is satisfactory. Therefore, the rich data collected in this study could help to deduce perceptions of users regarding the use of their existing ICTs.

When it comes to the existing ICTs, the results in Table 5.3 show that slightly more participants (54.1%) are using desktop computers than those (45.9%) who are using mobile technology, such as laptops. These figures indicate that both technologies are evenly represented. The results obtained in this study can thus be generalised across two types of technology, *mobile* and *desktop computers*. In order to put the SME in context the study investigated how long the SME had been operating. SMEs that have been in the industry for some time have experienced (both *negative* and *positive*) ICT changes in the market. Such participants could share their ICT-related experiences that would enrich the results of this study. SMEs that have been operating for the past 16 years or more, were 9.9% of the total participants and these were the least represented. SMEs aged between 10 and 12 years were 14.4% of the sample. Those SMEs aged between 4 and

6 years, and those between 13 and 15 years, had 15.8% and 16.7% representation, respectively. Those SMEs aged between 7 and 9, and those who were 3 years old and younger had the highest representation of 20.7% and 22.5%, respectively. The age of an SME was converted to a dichotomous variable by identifying the middle age and then grouping those ages either above or below the middle age. The two groups were, 9 years and less and 10 years and more. Figure 5.2 shows that slightly more (59%) of the SMEs had been operating for 9 years and less while 41% of the SMEs had been operating for 10 years or more. These are fairly similar figures. Therefore the results obtained by the study, and the conclusions drawn by such can be relied on, and generalised for all SMEs, regardless of their years in operation.

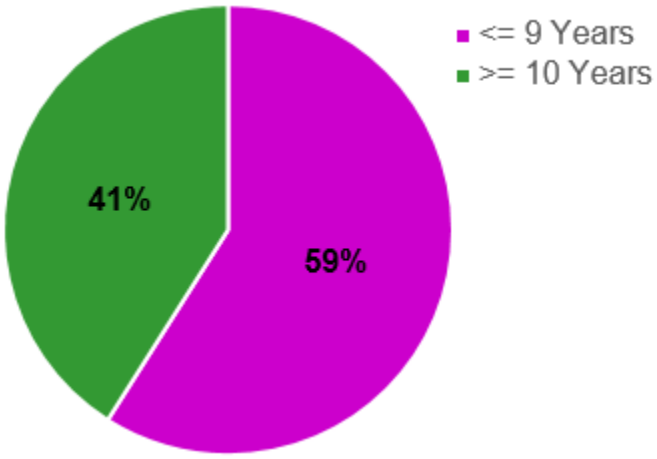

Figure 5.2: Frequency of SMEs Age (dichotomous variable)

5.3. Existing ICTs Frequency Analysis

The research study asked questions regarding the current existing ICTs. Questions asked about existing ICTs included:

1. Which technology are you currently using in your organisation?
2. Which year did you start using the existing technology in your organisation?
3. When was the technology you use in your organisation purchased?

4. Approximately what was the cost of acquiring the technology you are currently using in your organisation?
5. Approximately how much money per year do you make through use of the current technology in your organisation?
6. Approximately how much money per year do you budget for maintaining the technology you are currently using in your organisation?
7. For how many years would you continue to use the current technology before you purchase another one?

Questions 3, 4 and 5 were used to calculate NPV and payback period. These calculations will be discussed in detail in Section 5.6. Therefore, this section will only focus on the frequency analysis of Questions 1, 2, 3 and 7. Table 5.4 shows the frequency statistics results.

Table 5.4: Existing Technology frequency

Construct	Scale	Frequency	Per cent	Cumulative Per cent
Years of experience with current technology	ExpWithCurrentTech <= 3	35	15.8	15.8
	4 >= ExpWithCurrentTech <= 6	41	18.5	34.2
	7 >= ExpWithCurrentTech <= 9	41	18.5	52.7
	10 >= ExpWithCurrentTech <= 12	34	15.3	68.0
	13 >= ExpWithCurrentTech <= 15	44	19.8	87.8
	ExpWithCurrentTech >= 16	27	12.2	100.0
	Total	222	100.0	
Age of current technology	AgeOfCurrentTech <= 3	39	17.6	17.6
	4 >= AgeOfCurrentTech <= 6	43	19.4	36.9
	7 >= AgeOfCurrentTech <= 9	41	18.5	55.4
	10 >= AgeOfCurrentTech <= 12	41	18.5	73.9
	13 >= AgeOfCurrentTech <= 15	41	18.5	92.3
	AgeOfCurrentTech >= 16	17	7.7	100.0
	Total	222	100.0	

SME owners were also asked to state how long their business has been using existing ICTs by stating the year they started using their existing ICTs. Experience was then

computed by subtracting the stated year from the year 2017. The results show that 19.8% SME owners had 13 to 15 years of experience with the existing ICTs. Such SME owners had the highest representation. Those SME owners with 4 and 6 years of experience, and those between 7 and 9 years of experience, had representation of 18.5% each. A total of 15.8% of the SME owners had less than 3 years of experience with existing ICTs, followed by 15.3% of the SME owners who had 10 to 12 years of experience using existing ICTs. Those over 16 years of experience were the least represented: 12.2% of the total participants.

The variable ExpWithCurrentTech was computed into a dichotomous variable in order to better explore and understand the variable. The variable was divided into 2 groups and re-coded as follows: 9 years and below was coded '1' while 9 years and above was coded '2'. The new variable was named ExpWithCurrentTechBinary. Figure 5.3 shows the results of the dichotomous variable.

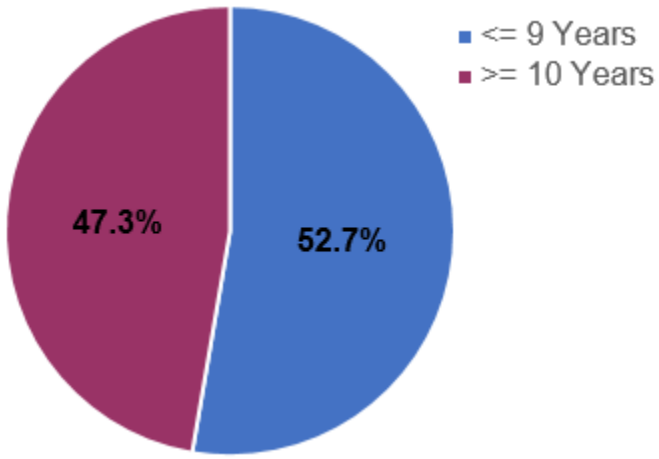

Figure 5.3: Experience with existing ICTs (dichotomous variable)

The results, shown in Figure 5.3, show a somewhat balanced depiction of years of experience with the use of existing ICTs between the two groups. Those with 9 years and less experience made up 52.7% of the total participants compared to their counterparts (who had more than 10 years of experience), representing 47.3% of the total participants.

These results will assist in validating the assumption that ICT users will prefer continuing use of ICTs they have experience of.

SME owners were also asked to state the year they purchased their existing ICTs. The purpose of this question was to ascertain the age of the existing ICTs: such helps in understanding the participants' emerging technology-adoption trends. The assumption is that the more time they spend using their existing ICTs, the less aggressive they are when it comes to the hasty adoption of the emerging DTs. SPSS was used to compute the age of the existing ICTs by subtracting the stated year from the year 2017. The computed variable was further re-coded into a new variable called AgeOfCurrentTech. The year values were grouped according to the following criteria: below 3 years, between 4 and 6 years, between 7 and 9 years, between 10 and 12 years, between 13 and 15 years and above 16 years. Table 5.4 shows that those with ICTs aged between 4 and 6 years had the highest representation: (19.4%) of the sample used in this study. ICTs between the ages of 7 and 9 years, those between the ages of 10 and 12 years and those between the ages of 13 and 15 years were equally represented at 18.5% each. A total of 17.6% of the SME owners indicated that their ICTs were newer than 3 years old. Those ICTs owned for over 16 years were the least represented, at 7.7%.

The AgeOfCurrentTech variable was further converted to a dichotomous variable with the name AgeOfCurrentTechBinary. The dichotomous variable was re-coded as follows: ICTs less than 9 years were coded '1' while those over 9 were coded '2'. Figure 5.4 show that 55.4% of the participants changed ICTs within 9 years of purchasing such. Some 44.6% kept their existing ICTs for over 10 years. Even though 55.4% of SMEs change their ICTs regularly, 44.6% use existing ICTs for longer. These results show that the groups are not far apart in terms of representation.

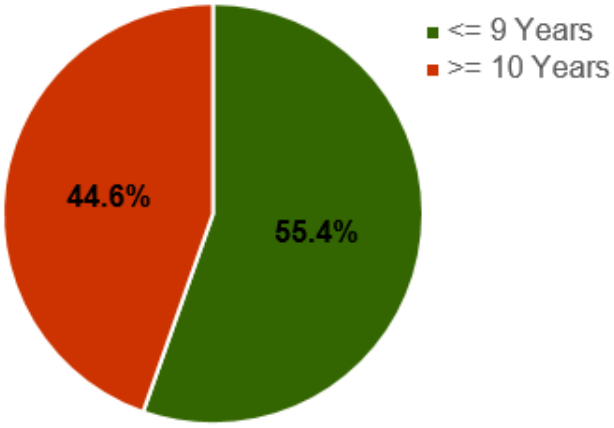

Figure 5.4: Age of current ICTs (binary variable)

5.4. Emerging DTs' Frequency Analysis

The research study asked the following questions regarding the emerging DTs:

1. Is there a technology that is likely to replace the one you are currently using in your organisation?
2. Approximately what is the cost of acquiring the new technology?
3. Approximately how much money per year do you think you can make through use of a new technology?
4. Approximately how much will it cost for maintenance, amongst other costs, of the new technology?
5. Approximately when do you think you will purchase the new technology?

This subsection will only focus on the frequency analysis of Questions 1 and 5. Table 5.5 presents the frequency statistics.

Table 5.5: Frequency of Emerging ICTs

Construct	Scale	Frequency	Per cent	Cumulative Per cent
Availability of new tech	Yes	188	84.7	84.7
	No	34	15.3	100.0
	Total	222	100.0	
New tech purchase year	NewTechPurchase <= 3	72	32.4	32.4
	4 >= NewTechPurchase <= 6	65	29.3	61.7
	7 >= NewTechPurchase <= 9	66	29.7	91.4
	10 >= NewTechPurchase <= 12	19	8.6	100.0
	Total	222	100.0	

Table 5.5 above shows that 84.7% of the participants confirmed that there are emerging DTs on the market that would likely replace the existing ICTs in their organisation. A total of 15.3% indicated that, currently, there are no emerging DTs on the market that could replace the existing ICTs in their organisation. The interesting statistic is the frequency of those participants who confirmed that there were emerging DTs that offered competition with the existing ICTs in their organisation. Given the goal of the study, the perceptions of SME owners who have not identified competing emerging DTs will not yield rich data. Therefore the 84.7% of those who confirmed that there are competing emerging DTs in the market will provide conclusive data.

SME owners were also asked to specify the anticipated year in which they would replace their existing ICTs. The question required an exact number in the form of an integer. Hence, the study had to convert by means of re-coding the integer values into grouped data with scales. The scales used were: NewTechPurchase <=3, 4>= NewTechPurchase <=6, 7>= NewTechPurchase <=9 and 10>= NewTechPurchase <=12. The results show that 32.4% of the participants were likely to purchase the emerging DTs within the next 1 to 3 years. Some 29.7% of the participants would purchase the emerging DTs within the next 7 to 9 years. This was followed by an almost equivalent number (29.3%) of participants who indicated that they were likely to purchase the emerging DTs within the next 4 to 6 years. The least represented were those who would purchase the emerging DTs within the next 10 to 12 years: only 8.6% of the total sample used in this study.

Based on cumulative frequency, the results in Table 5.5 show that most of the participants would change their existing ICTs by adopting emerging DTs. This is shown by 61.7% of the participants who might change their technologies within the next 6 years. These results agree with the results of the aforementioned statistics of the variable [availability of new tech] which indicated that the majority of the SME owners had already identified emerging DTs which could compete with the existing ICTs. The percentage of those respondents which have identified competing emerging DTs (84.7%) is not equivalent to the percentage of those who were likely to change their existing ICTs within the next 6 years (61.7%). We could thus deduce that some participants, who indicated that there were emerging DTs that offered competition, were not going to adopt them soon, no matter the advantages they offered. This might also be attributed to the gap identified by this study, that there is lack of a framework to assist SME owners with evaluating their existing ICTs.

5.5. Descriptive Statistics of Constructs

A proper data analysis must commence with an independent analysis of each variable's statistical attributes. This kind of analysis is known as univariate analysis. An example of a statistical method in this category is descriptive statistics. Descriptive analysis provides rich information about a variable, and includes:

- How the values of a variable, whether normal or binomial, are distributed.
- The central tendency of the variable values indicated by the following statistics: median, mean, minimum, and maximum.
- Value dispersion shown by the following statistics: quartile, standard deviation, range, variance, kurtosis, and skewedness.
- Presence of extreme values (outliers).

Descriptive statistics were used to summarise the perceptions of SME owners regarding the evaluation of existing ICTs before the adoption of emerging DTs. Descriptive statistics

were extracted from SPSS for the following constructs: OF, EF, EE, PE, BI, US, SF, Hw, Sw, Inf, Nw, Db, Cc, and OE. Such were based on the Likert scale, where ‘strongly disagree’ was represented by ‘1’, ‘disagree’ by ‘2’, ‘neutral’ by ‘3’, ‘agree’ by ‘4’, and ‘strongly agree’ by ‘5’. Table 5.6 records the descriptive statistics.

The results in Table 5.6 record that seven (7) out of 14 constructs had 3 or ‘neutral’ as the minimum option chosen by the SME owners. This means that for Hw, Sw, Inf, Nw, EE, PE and US, none of the participants ‘disagree’ or ‘strongly disagree’ with the questions asked about them. The mean result also suggested the same for these seven variables. The mean value for the seven variables was found to be above 4.0 when rounded off to the nearest whole number, a value that stands for ‘agree’. This means that the majority of the SME owners agreed and strongly agreed to the questions asked about the effect of these factors on evaluation of the existing ICTs. Five (5) factors (Db, Cc, OF, BI and OE) had a minimum option chosen of ‘2’ or ‘disagree’; while only two (2) factors (SF and OE) had a minimum option chosen of ‘1’ or ‘strongly disagree’. These are the only factors that had some SME owners disagreeing/strongly disagreeing to the questions on the role of those factors in evaluating existing ICTs. However, the mean of all these factors, except for OE, shows that the majority of the SME owners’ opinions are aligned on the right side of the neutral option. They therefore strongly agreed and agreed with the questions asked about them. OE had a mean value of 3.0360 which stands for neutral. There is a balance between SME owners who agree/strongly agree, and those who disagree/strongly disagree with the questions about OE.

Table 5.6: Descriptive Analysis of the Constructs

Construct	N	Minimum	Maximum	Mean
Hw	222	3.00	5.00	4.2523
Sw	222	3.00	5.00	4.1982
Inf	222	3.00	5.00	4.0631
Nw	222	3.00	5.00	3.8423
Db	222	2.00	5.00	3.7432
Cc	222	2.00	5.00	3.8649
EE	222	3.00	5.00	4.0901
PE	222	3.00	5.00	3.7748
SF	222	1.00	5.00	3.5405
OE	222	1.00	5.00	3.0360
OF	222	2.00	5.00	4.2523
BI	222	2.00	5.00	3.9640
US	222	3.00	5.00	3.5315
OE	222	2.00	5.00	3.5631
Valid N (listwise)	222			

Lastly, SME owners were requested to rate their overall perceptions on the evaluation of existing ICTs. The purpose was to ascertain whether SME owners were still impressed with their existing ICTs. The results in Table 5.6 record the mean for overall evaluation as 3.5631. Such is approximately equal to 4.0 after rounding off to the nearest integer. Therefore slightly more participants ‘agree’ and ‘strongly agree’ that the existing ICTs are still preferred and better than emerging DTs. A histogram was extracted from SPSS using a minimum of 1 and maximum of 5, as per Figure 5.5. The pictorial representation of the histogram in Figure 5.5 shows that the data depict a slightly normal distribution. ‘Agree’ was well represented with 51.4%, followed by ‘neutral’ with 44.1%. ‘Strongly agree’ scored third-highest with 3.2%, and ‘disagree’ scored the least with 1.4%. These percentage frequencies mean that 51.4% of the SME owners agreed that the existing ICTs are better than the emerging DTs. A total of 44.1% of the SME owners are not sure whether existing ICTs are better than emerging DTs. Some 3.2% of the participants ‘strongly agree’ that the existing ICTs are better than the emerging DTs. Only 1.4% of the participants disagree that existing ICTs are better than the emerging DTs. Overall, we can conclude that majority of SME owners are happy with their existing ICTs.

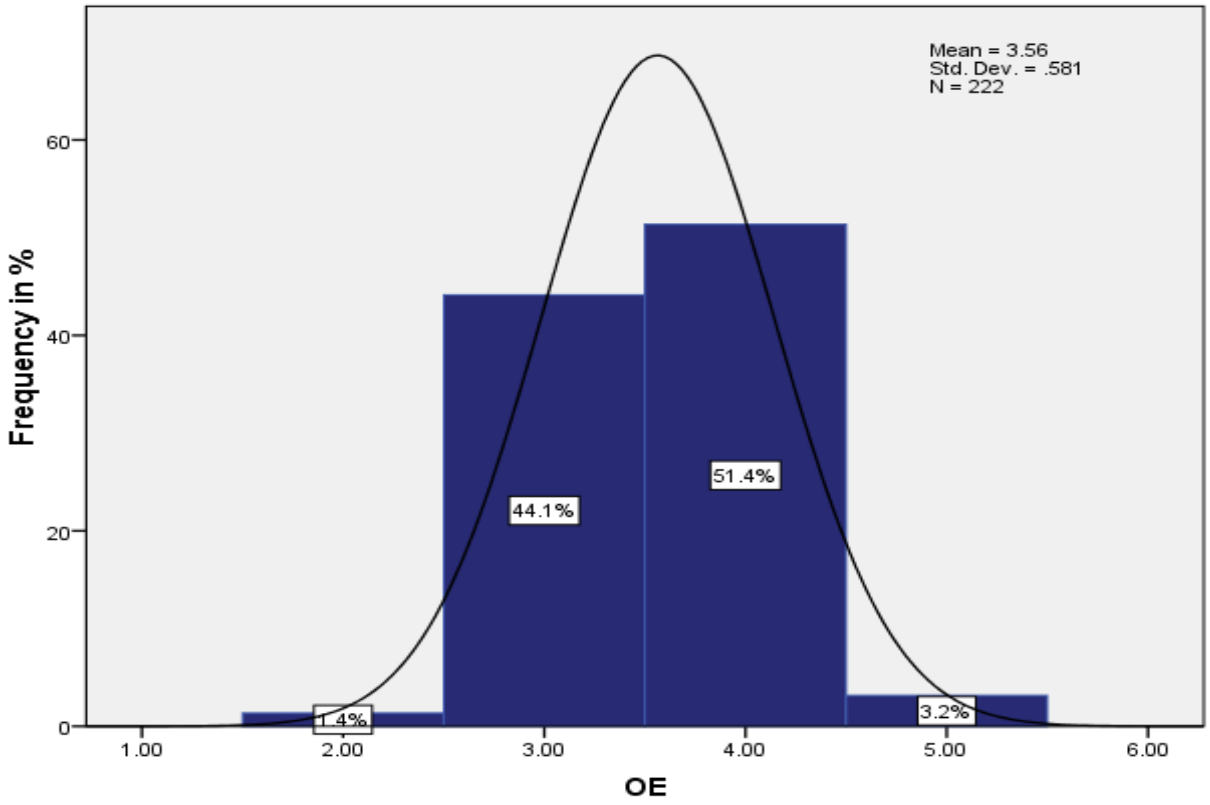

Figure 5.5: Histogram of overall evaluation in percentages

Descriptive statistics are sufficient only to understand the distribution and central tendency of data. However, when one wants to investigate relationships amongst constructs, descriptive statistics are insufficient. Hence, the use of inferential statistics such as SEM becomes paramount. SEM results will be discussed in Section 5.7.

5.6. Analysis of FEMs Variables

The subsequent section details ‘net present value’ and ‘payback period’ analysis.

5.6.1 Net present value

The study computed the net present value (NPV) in Excel, thereafter transferring the data to SPSS. NPV was calculated using the formulas obtained from literature. Table 5.7 indicates a sample data on which the NPV was calculated. The table shows that NPV was calculated using three variables: *year diff* which stands for year difference, *purchase cost*, and *profit*. Year diff was calculated by subtracting the year the existing ICTs were purchased, from the current year, which was 2017, during the time of analysis. The year the existing ICT was purchased was requested in Question 3, purchase cost was asked in Question 4, while Question 5 addressed profit. NPV was consequently calculated using the following formula:

=profit *((1-(1+0.12)^- year diff)/0.12)-purchase cost.

Table 5.7: Sample Computation of NPV

A	L	M	N	CT	CU
	Year Diff	**Purchase Cost**	**Profit**	**NPV**	
	1	550000	5000000	3914285.714	
	1	3000	100000	86285.71429	
	1	15000	800000	699285.7143	
	10	3400	85000	476868.9574	
	4	6800	80000	236187.9477	
	5	5000	300000	1076432.861	
	3	25000	2000000	4778662.536	
	9	2500	40000	210629.9917	
	1	12000	250000	211214.2857	
	5	35000	1000000	3569776.202	
	11	50000	800000	4700159.306	

As mentioned in Section 3.4.2, a negative NPV will influence SME owners to consider the adoption of emerging DTs, while a positive NPV will influence them to accept continued use of existing ICTs. Therefore, the study had to re-code NPV values so that negative values would be re-coded with a ‘1’, and positive values would be re-coded with a ‘2’. However, as shown in table 5.8 the study discovered that all calculated NPV values were

positive, having a minimum and maximum value of 7697.33, and 4778662.54, respectively.

Table 5.8: Descriptive Statistics of NPV

Construct	N	Minimum	Maximum	Mean
NPV	222	7697.33	4778662.54	1344524.7318
Valid N (listwise)	222			

The final value of NPV has three possible values: zero, positive, and negative (Žižlavský, 2014). A zero value means that the ICT investment is no longer useful; a negative NPV means the ICT investment is facing replacement; while a positive NPV value means that the ICT investment still has great potential to generate more cash inflow (Žižlavský, 2014). All positive NPV obtained in this study indicates that SME owners would likely continue to use the existing ICTs as they still have a great potential to generate more cash inflow (Žižlavský, 2014). The dichotomous variable of NPV had 100% representation for option 1 which stood for positive NPV and 0% representation for option 2 which stood for negative NPV. This group imbalance poses a challenge when analysing the variable using SEM. (Gobo, 2004; Kline, 2005; Hair *et al.*, 2006). As a result, NPV was left out of SEM analysis.

5.6.2 Payback period

As with NPV, payback period was calculated using Excel, before being transferred to SPSS. Table 5.9 illustrates how the payback period for a single participant's ICT was calculated. Row 3 in Table 5.9 indicates the years, with time-zero year (2016) being the year in which the existing ICTs were purchased. Years 1, 2, to 5, were the forecasted years. Initial outlay in cell C4 represents the initial capital used to purchase the ICTs, in this case R550 000, as per Table 5.9. Cash inflow represents the amount of capital generated by the ICTs, which is 0 for time zero (the year in which the existing ICTs were purchased). However, for other years, the SME owners were required to indicate the amount of money they generate per year as a result of using the existing ICTs. Table 5.9

indicates that their ICTs generate R5 million per year. Row 6 represents the cumulative cash flow for a particular year, which is calculated by adding the cash generated in the year to the cash generated in the previous year. For instance, cumulative cash flow for Year 3 is calculated by adding cell F5 to cell E6. Row 8 is computed by obtaining the absolute value of the division of the *cumulative cash flow cell* by the *cash inflow cell*. For example, cell D8 is calculated by using the following formula: =ABS(C6/D5), where ABS stands for the absolute function which converts any number, whether positive or negative, to a positive value.

Table 5.9: Sample Computation of Payback Period

	A	B	C	D	E	F	G	H	I
1									
2			**Time Zero**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	
3			2016	2017	2018	2019	2020	2021	
4		**Initial Outlay**	550000						
5		**Cash inflow**		5000000	5000000	5000000	5000000	5000000	
6		**Cumulative Cash flows**	-550000	4450000	9450000	14450000	19450000	24450000	
7									
8		**ABS(Cumulative Cash flows / Cash inflow)**	-	0.11	0.89	1.89	2.89	3.89	
9									
10		**Full years where cumulative cash flow is negative**	0						
11		**Partial years where cumulative cashflow is negative**	0.11						
12		**Payback period**	0.11						
13									

Cell C10 calculates the full years that have a negative cash flow. Cell C10 is calculated by counting the total number of years that cash inflow was negative. This cell was calculated using the following formula: =COUNTIF(D6:H6,“<”&0), which counts all cells from D6 to H6, where their value is less than 0. In Table 5.9, the number of full years when cumulative cash inflow is negative, is 0. Furthermore, the partial years where cumulative cash flow is negative was calculated by obtaining the index of the first cell (where the cash inflow was negative). After obtaining the index, a value of 1 was added to the index to give the first cell a positive value. The formula used was: =INDEX(D8:H8,COUNTIF(D6:H6,“<”&0)+1). In Table 5.9, the index between D8 and H8 was found to be 0; which was then added to the value 1 to give an index of 1. Hence Excel extracted the value in a cell with Index 1 in the specified range D8:H8. Lastly, the study calculated the payback period in cell C12. The value was calculated by adding cell C11 to cell C10. In this example, the payback period was found to be 0.11 years (1.3

months). This means that this participant managed to raise the initial capital used to purchase the ICTs in the first 1.3 months. This procedure was repeated for all the participants in the study. When the *payback period* for each participant had been calculated, these values were moved to SPSS.

SPSS was consequently used to analyse the descriptive statistics for the payback period, in years. Table 5.10 presents these results.

Table 5.10: Descriptive Statistics of Payback Period in Years

Construct	N	Minimum	Maximum	Mean	Std Deviation	Skewness
PBK	222	.00080000	5.00000000	.2391531532	.54894867060	6.454
Valid N (listwise)	222					

The results in Table 5.10 show that the minimum and maximum years for which SME owners retained their cost of ICTs was 0.0008 years, and 5.00 years, respectively. This means that some participants recovered their initial cash outlay within the first month of the first year of operation or use of the purchased ICTs, while others took 5 years to recover the capital they had initially used to purchase the existing ICTs. The mean was 0.2392 years; which suggests that most participants recovered their initial cash outlay within the first 2 months of the year (0.2392 years * 12 months in a year). When it comes to the spread of the payback period around the mean, the skewness value shows that the majority of participants are aligned to the left side of the mean, as shown by the positive skewness value of 6.454 (Pallant, 2020). As per the descriptive statistics in Table 5.10 above, most participants recovered their initial cash outlay within the early years of purchasing the ICTs. To better elucidate the payback period results, the study extracted a histogram with a normal distribution curve presented in Figure 5.6.

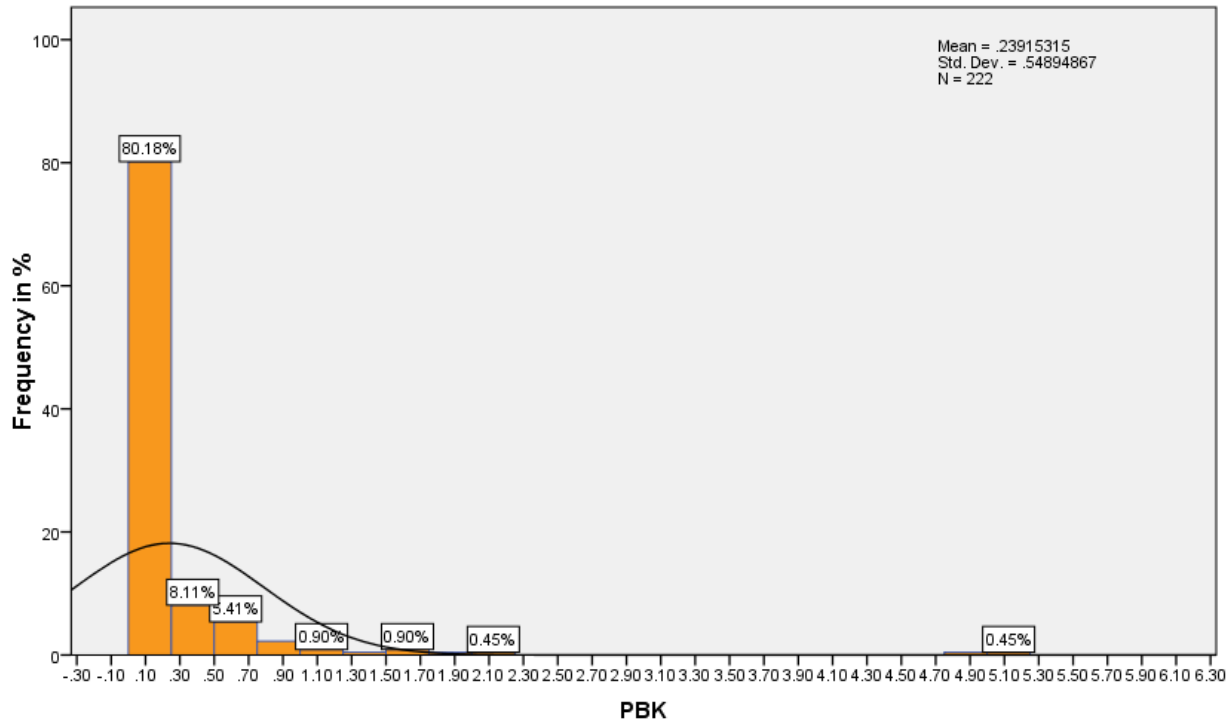

Figure 5.6: Histogram of *payback period* in years

Figure 5.6 indicates that most of the data points are shifted to the left side of the median, or middle value. This agrees with the results of mean and skewness recorded in Table 5.10. However, Figure 5.6 shows that some participants (0.45% of the total sample for this study) indicated that they had recovered their initial cash outlay within 4.8 to 5.3 years. Similarly, there is a significant gap between these participants and those who noted that they had recovered their initial cash outlay within the first 2 years. This resulted in a very skewed distribution, in which the mean and other distribution statistics would not yield a descriptive trend. Thus another histogram was extracted, with minimum and maximum values of 0, and 2.5 years, respectively, as per Figure 5.7. The purpose was to remove outliers.

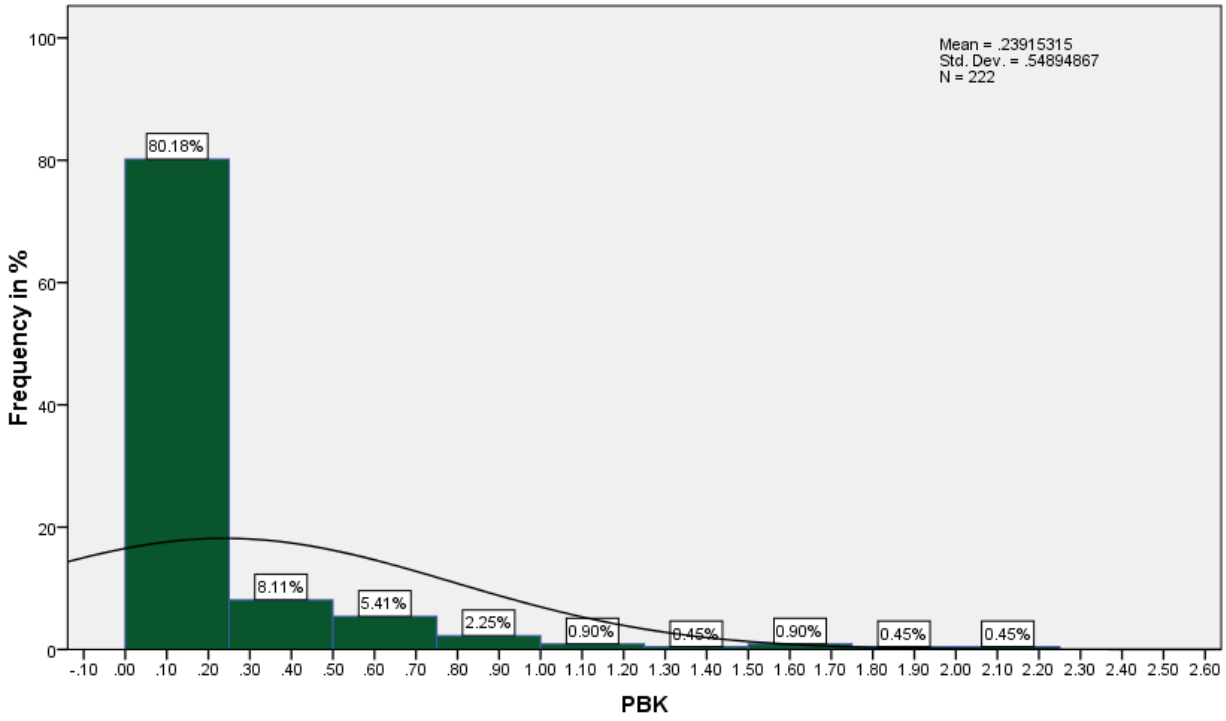

Figure 5.7: Histogram of *payback period* in years with outliers removed

Figure 5.7 shows a better distribution of the payback period data compared with Figure 5.6. Figure 5.7 illustrates that, with a mean of 0.2392, the majority of the SME owners are concentrated towards the left-hand side of the mean. This signifies that most of the SME owners recovered their initial cash outlay within the early stages of the implementation. The graph further indicates that 80.2% of the participants recovered their initial cash outlay during the first 0.25 years, approximately 3 months (0.25 years * 12 months in a year). This was followed by 8.11% of the participants, who indicated that they recovered their initial cash outlay within the first 0.5 years (equal to 6 months). Some 5.41% of the SME owners indicated that they recovered their initial cash outlay in 0.75 years (equal to 9 months), while 2.25% of the SME owners indicated that they regained their initial cash outlay during the first 0.75 to 1 year. Collectively, 3.2% of the SME owners indicated that they had failed to recover their initial cash outlay within the first year of implementation.

Generally, the results indicate that the majority of SME owners managed to recover the initial capital they had used to purchase the existing ICTs. Most managed to recover their

initial cash outlay within the first 3 months of operation. We therefore anticipate that these participants would favour their existing ICTs, rather than adopting emerging DTs, benefiting from initial ICTs.

The values for PBK ranged from 0.0008 to 5.0, which were then grouped and re-coded as follows: 0 – 0.2 was re-coded to 1; 0.3 - 0.5 was re-coded to 2; 0.6 - 0.8 was re-coded to 3; 0.9 - 1.1 was re-coded to 4; and values above 1.11 were re-coded to 5. It was possible to include PBK in SEM analysis as its re-coded scale was similar to that of the non-financial. However, as NPV was found to have a single value of 1, which represented positive NPV, the study excluded NPV from CFA. The FEMs construct was left with only a single construct item, namely, PBK. This led to the exclusion of the whole FEMs construct from SEM, it being left with only one construct item. Two or more observable variables are needed to have a latent variable in CFA, with three or more being preferred. Therefore, the FEMs variable could not be included in the confirmatory analysis, containing only a single observable variable (Ding, Velicer and Harlow, 1995; Gobo, 2004; Kline, 2005; Hair *et al.*, 2006).

5.7. The Measurement Model

After frequency and descriptive statistical analysis of the sample data, the study conducted SEM analysis, based on the procedure detailed in Section 4.7.3. The measurement model is illustrated in Figure 5.8. The figure shows the connection by double-headed arrows of a latent variable (construct) with another latent variable, as well as the connection between latent variables and observable variables (construct items) represented by rectangular shapes using single-headed arrows. The figures on each path are termed structural (path) coefficients.

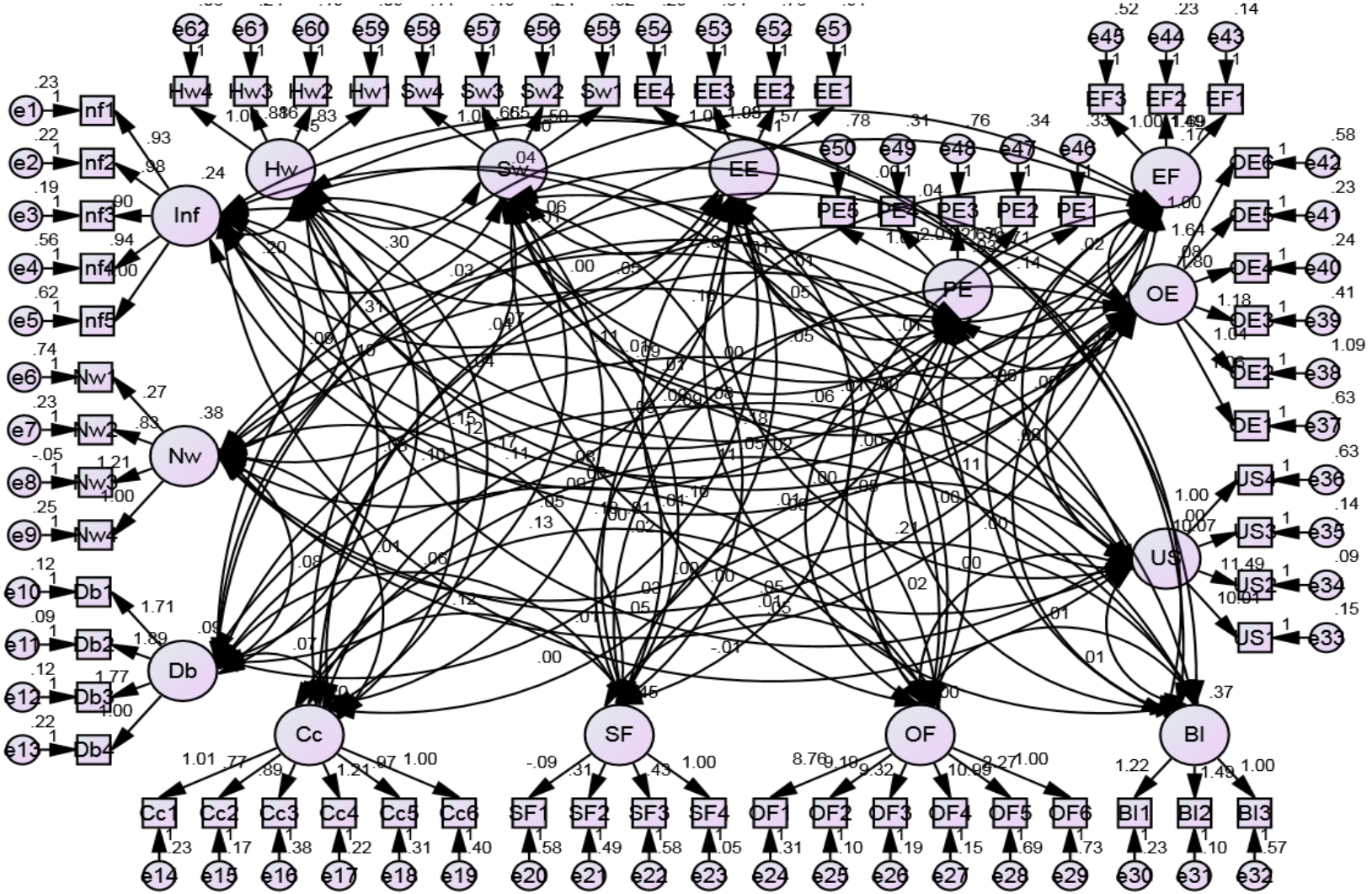

Figure 5.8: The measurement model

After the measurement model had been run, the study extracted the fit indices. Table 5.11 presents the fit indices' measurements from AMOS output, against their suggested threshold values.

Table 5.11: Measurement Model Fit Indices

Measurement Fit Indices		Obtained Measurement Model Value	Measurement Fit Indices' Threshold Level	Recommendations
Chi Square	$\chi 2$	13326.513	$2.1 \leq \chi^2/d.f \leq 3.1$	Above the maximum threshold of 3.1, suggesting model modification.
	d.f	1738		
	$\chi^2/d.f$	7.668		
SRMR		0.079	RMR ≤ 0.08	Below 0.08 which shows good fit.
RMSEA		0.174	0.05≤ RMSEA ≤ 0.080	Above the maximum threshold of 0.08, suggesting model modification.
GFI		0.454	GFI ≥ 0.90	Below 0.90, suggesting model modification.
CFI		0.314	CFI ≥ 0.950	Below 0.95, suggesting model modification.

Table 5.11 indicates that only the SRMR indicated good model fit, while χ^2, RMSEA, CFI, and GFI recommended model modification. This result does not surprise, given SEM's complexity. It is common to find that the first model fit is poor (Kline, 2005; Hooper, Coughlan and Mullen, 2008). The measurement model should be refined and modified until a better fit of the model is achieved (Kline, 2005; Hooper, Coughlan and Mullen, 2008). Therefore, attempts were made to modify the model to fit the data, thus facilitating more accurate results.

5.7.1 Modification of measurement model

As mentioned in Section 4.7.3, the measurement model was modified by deleting and/or amending the observable variables which would not result in the distortion of values in the measurement model. The study perused the output from AMOS, using elimination criteria recommended by Jöreskog and Sörbom (1993), in order to identify these indicators. Tables 5.12 and 5.13 illustrate the covariance and regression weights output from AMOS, which were earmarked for modification or elimination.

Table 5.12: Error Terms Covariance

Error Terms	Covariance	Error Terms	Covariance	Error Terms	Covariance
e20<--> e48	**106.914**	e22<-->e48	**26.185**	e5<-->e4	**75.808**
e45<-->e48	**26.618**	e18<-->e54	**58.668**	e28<-->e44	**23.930**
e33<-->e60	**44.429**	e8<-->e61	**23.031**	e2<-->e17	**41.599**
e8<-->e35	**35.112**	e5<-->e6	**44.166**	e8<-->e47	**23.533**
e19<-->e16	**45.768**	e5<-->e43	**22.479**	e10<-->e19	**39.120**
e17<-->e46	**23.705**	e28<-->e30	**30.040**	e25<-->e52	**20.455**
e60<-->e54	**33.378**	e18<-->e47	**20.452**	e42<-->e39	**33.601**
e55<-->e47	**23.502**	e36<-->e52	**31.942**	e12<-->e31	**19.143**
e36<-->e45	**38.402**	e31<-->e36	**19.684**	e32<-->e35	**32.900**
e24<-->e30	**21.118**	e24<-->e62	**30.676**	e51<-->e48	**16.361**
e36<-->e35	**32.817**	e44<-->e48	**16.689**	e16<-->e30	**40.827**
e34<-->e59	**29.276**	e13<-->e49	**32.928**	e26<-->e45	**35.869**
e55<-->e49	**32.841**	e62<-->e51	**15.028**	e1<-->e61	**42.290**
e59<-->e47	**20.723**	e4<-->e15	**39.832**	e27<-->EE	**30.454**
e11<-->e56	**29.113**	e26<-->e25	**31.648**	e26<-->e34	**28.259**
e27<-->e25	**22.521**	e60<-->e52	**29.618**	e27<-->e26	**20.513**
e17<-->e57	**33.828**	e22<-->e50	**21.238**	e13<-->e23	**29.698**
e18<-->e31	**18.477**	e48<-->e47	**26.224**	e6<-->e16	**22.722**
e38<-->e37	**26.006**	e6<-->e31	**23.263**	e6<-->e27	**25.224**
e4<-->e22	**19.935**	e32<-->e56	**24.856**	e13<-->e29	**16.141**
e59<-->e50	**23.756**	e5<-->e13	**17.304**	e33<-->e44	**23.676**
e20<-->e50	**16.048**	e29<-->e32	**30.297**	e62<-->BI	**22.214**
e9<-->e11	**31.642**	e3<-->e58	**16.943**	e36<-->e51	**12.100**
e26<-->e43	**13.445**	e18<-->e58	**13.958**	e12<-->e47	**12.110**
e12<-->e15	**10.473**	e6<-->e19	**10.384**	e62<-->e49	**11.692**
e34<-->e49	**13.880**	e55<-->e51	**13.726**	e55<-->Nw	**17.977**
e12<-->NW	**10.784**	e43<-->e55	**10.889**	e43<-->US	**9.726**
e30<-->US	**9.068**	e13<-->e18	**9.237**	e59<-->e25	**7.730**
e33<-->e54	**8.195**	e55<-->e5	**7.111**	e38<-->e43	**8.352**
e44<-->e25	**7.144**	e15<-->e44	**9.611**	e8<-->e15	**9.762**
e18<-->e32	**10.168**	e12<-->e56	**8.398**	e15<-->e45	**9.486**
e16<-->e56	**7.092**	e18<-->e16	**7.869**	e15<-->BI	**7.612**
e18<-->e22	**8.266**	e12<-->e5	**7.046**	e55<-->Inf	**7.027**
e18<-->e43	**7.207**	e12<-->e26	**6.602**	e29<-->e5	**7.078**

e12<-->EF	**6.412**	e12<-->e51	**5.082**	e56<-->e13	**5.443**
e32<-->e33	**6.740**	e43<-->e59	**5.274**	e33<-->Hw	**5.546**
e12<-->e42	**5.896**	e33<-->e13	**7.105**	e43<-->e60	**5.772**
e19<-->e25	**4.690**	e39<-->SF	**5.674**	e13<-->e27	**4.641**
e47<-->Inf	**6.168**	e26<-->e49	**6.045**	e34<-->e15	**4.991**

Error terms in Table 5.12 had the potential to cause higher values of χ^2 and other fit indices. Table 5.12 demonstrates that, should the covariance between e20 and e48 be developed, the χ^2/d.f value would drop by 106.914. Hence, all covariances between error terms in Table 5.12 were developed, resulting in a significant change in all fit indices.

Furthermore, Table 5.13 shows regression weights between constructs and indicators that would cause a change in the value of χ^2. Some of the construct items for these constructs were deleted. With some constructs, such as behavioural intention to continue using the existing ICTs, which only had three construct items, none of the items were deleted: deleting a single indicator would lead to distortion of the meaning. As such, only constructs with four or more construct items, and paths with a larger regression weight, were considered for deletion.

Table 5.13: Regression Weights between Constructs and Construct Items

Path	**Regression weights**	**Path**	**Regression weights**	**Path**	**Regression weights**
Cc1<-- PE4	**39.061**	SF2<-- US4	**27.771**	OF5<-- Hw	**23.049**
Cc4<-- EE2	**25.354**	Hw3<-- Db4	**20.066**	Inf2<-- PE2	**18.990**
Sw3<-- Nw2	**13.001**	Nw2<-- BI3	**15.004**	OF1<-- PE1	**22.055**
Inf1<-- PE4	**21.137**	OF4<-- OF2	**125.523**	PE1<-- EE2	**18.990**
EE3<-- Db1	**19.709**	EF3<-- OF4	**24.938**	Nw3<-- EE2	**24.978**
PE2<-- Hw4	**22.050**	Db1<-- EF3	**26.171**	PE4<-- Sw4	**25.131**
US2<-- Inf4	**20.326**	EE1<-- Hw1	**16.303**	Sw1<-- PE3	**16.808**
Inf5<-- OF2	**15.586**	US1<-- Inf5	**17.236**	OF3<-- Sw1	**15.041**
PE2<-- Sw4	**16.123**	PE2<-- BI1	**16.041**	PE4<-- Db4	**14.828**
Db1<-- SF3	**13.941**	Cc5<-- EF3	**13.509**	US1<-- Db1	**13.814**
PE5<-- Db4	**11.914**	Db1<-- Db4	**10.531**	US1<-- OF6	**10.457**
US1<-- SF1	**10.394**	Db3<-- OE3	**10.309**	SF4<-- PE4	**10.274**

PE4<-- EF3	**9.692**	Db3<-- SF3	**13.255**	PE2<-- EE4	**8.487**
BI1<-- EE2	**8.671**	US1<-- Cc3	**7.456**	Db2<-- US1	**9.144**
Cc5<-- Nw3	**8.595**	OF3<-- Inf4	**7.974**	OF3<-- US4	**7.565**
Db2<-- Cc2	**7.052**	Cc6<-- Inf4	**7.438**	Db2<-- Inf3	**8.567**
Inf3<-- BI1	**7.624**	Cc6<-- SF3	**7.131**	Sw4<-- SF1	**6.364**
EF1<-- SF1	**8.625**	Sw2<-- SF1	**7.810**	Cc3<-- SF1	**10.343**
EF2<-- PE3	**8.201**	EF1<-- US4	**6.881**	EF1<-- OF4	**8.466**
Hw1<-- PE4	**6.703**	Nw1<-- PE2	**6.731**	Inf5<-- PE3	**8.022**
Nw1<-- Db4	**7.415**	BI3<-- Cc3	**6.586**	EF2<-- Cc3	**7.825**
Db2<-- EF2	**6.872**	US1<-- Nw3	**5.630**	SF4<-- EF3	**5.490**
EE4<-- EF3	**6.872**	EE4<-- OF2	**5.787**	EE4<-- OF2	**6.872**
Db2<-- EF2	**6.872**	Hw1<-- SF	**5.589**	EE4<-- OF2	**6.872**
SF4<-- Inf4	**6.417**	BI2<-- PE2	**5.472**	OF2<-- US	**6.416**
EF2<-- Db4	**6.377**	Db3<-- EE4	**6.196**	Hw2<-- Nw3	**6.388**
Nw1<-- US4	**5.949**	Sw1<-- EE4	**7.069**	PE5<-- US4	**6.881**
Hw2<-- PE3	**6.485**	Hw2<-- PE5	**5.455**	OF3<-- EE1	**5.685**
EF2<-- SF	**5.165**	EE1<-- Db4	**5.409**	OF3<-- SF	**4.989**
OE1<-- Sw2	**4.928**	OE6<-- BI1	**4.980**	EF1<-- EE1	**4.841**
US4<-- OF4	**4.494**	BI3<-- EF3	**5.575**	Hw4<-- Nw	**4.351**
EF2<-- PE4	**4.088**	US1<-- Sw1	**4.140**	EF2<-- PE4	**4.088**
Hw1<-- Db4	**4.118**	US3<-- Cc6	**4.819**	Cc2<-- Cc6	**5.002**
US3<-- Inf3	**4.621**	EF3<-- BI	**4.819**	Cc2<-- Sw4	**5.141**
OF3<-- Sw4	**5.400**	EE1<-- OF2	**4.423**	US2<-- SF1	**4.200**
Hw1<-- SF1	**4.008**	EE1<-- SF1	**6.198**	Hw4<-- SF3	**4.458**

The observed variables, or construct items, which were finally deleted, are listed in Table 5.14.

Table 5.14: Deleted Construct Items

Construct	Construct Item
Hw	Hw3
Sw	Sw3
Inf	Inf1 and Inf2
Nw	Nw3
Cc	Cc1
SF	SF2
PE	PE1

EE	EE3
OF	OF1 and OF5
US	US5
OE	OE4

5.7.2 Measuring the model fitness

After modification the measurement model was re-run, and new fit index values were extracted. Figure 5.9 depicts the final model with deleted and covaried construct items.

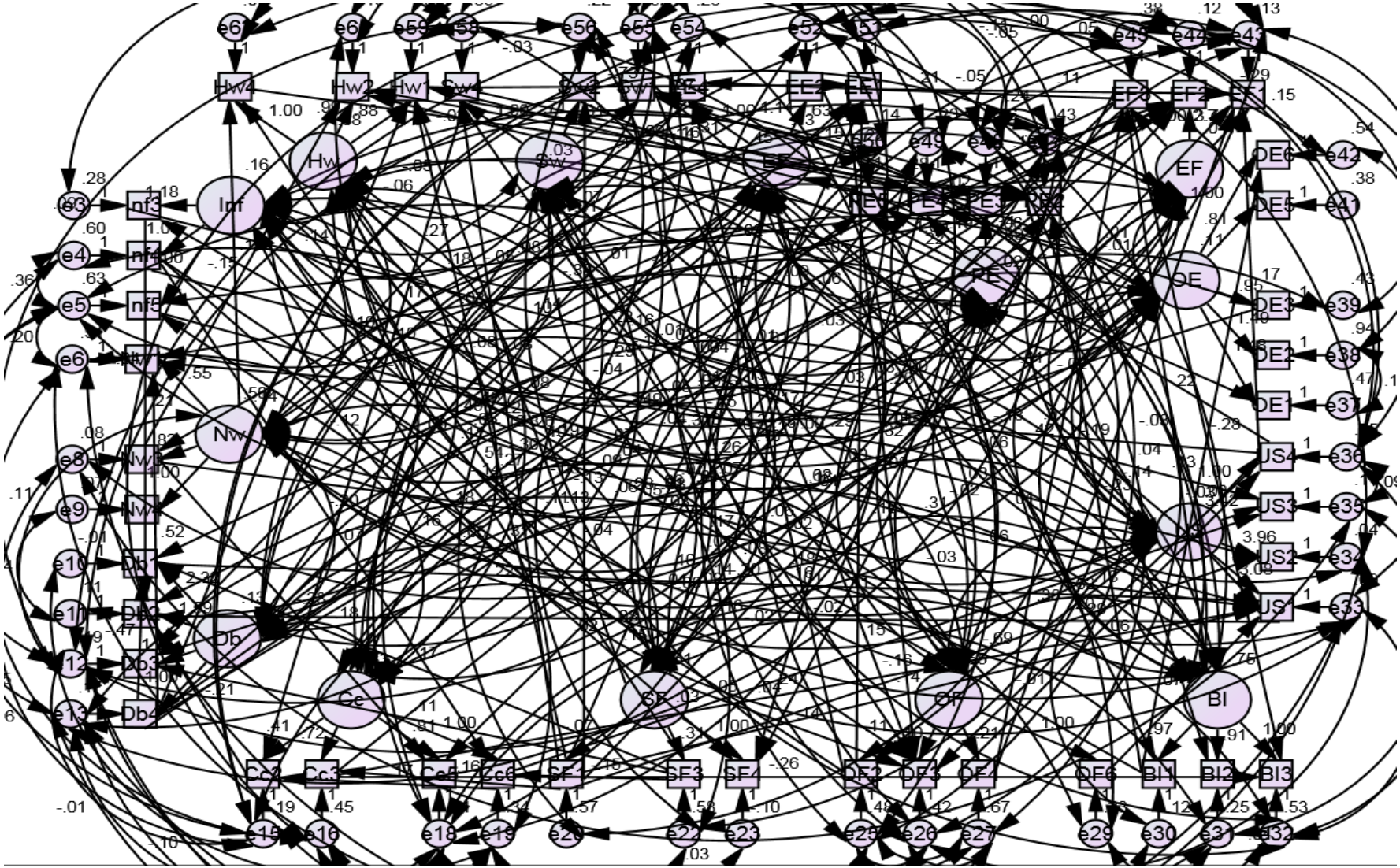

Figure 5.9: The final measurement model

Fit indices' measurements results, as extracted from AMOS, are recorded in Table 5.15. The results show that two fit indices (χ^2/d.f and SRMR) showed that the model fit was good. The remaining fit indices (CFI, RMSEA and GFI) were slightly below the threshold level, suggesting further modification of the measurement model. However, AMOS suggested no further modification, which meant that this was the best fit the model could achieve. SEM is a complex method of analysis, such that achieving model fit with two or more fit indices is acceptable (Kline, 2005; Hooper, Coughlan and Mullen, 2008).

Table 5.15: Deleted Construct Items

Measurement Fit Indices		**Obtained Measurement Model Value**	**Measurement Fit Indices' Threshold Level**	**Recommendations**
Chi-Square	χ2	2228.873	2.1 ≤ χ^2 /d.f ≤ 3.1	Indicates good fit since χ2/d.f was within the threshold range
	d.f	834		
	χ^2/d.f	2.673		
SRMR		0.062	RMR ≤ 0.08	Below 0.08 which shows good fit.
RMSEA		0.087	0.05 ≤ RMSEA ≤ 0.080	Slightly above the maximum threshold of 0.08, suggesting model modification.
GFI		0.775	GFI ≥ 0.90	Below 0.90, suggesting model modification.
CFI		0.865	CFI ≥ 0.950	Below 0.95, suggesting model modification.

The deletion of suggested observed variables assisted in remaining with the essential indicators of the evaluation of existing ICTs, before adopting emerging DTs. Figure 5.10 shows a polished model with standardised loadings for each construct item. The figure requires no further deletion or modification of parameters.

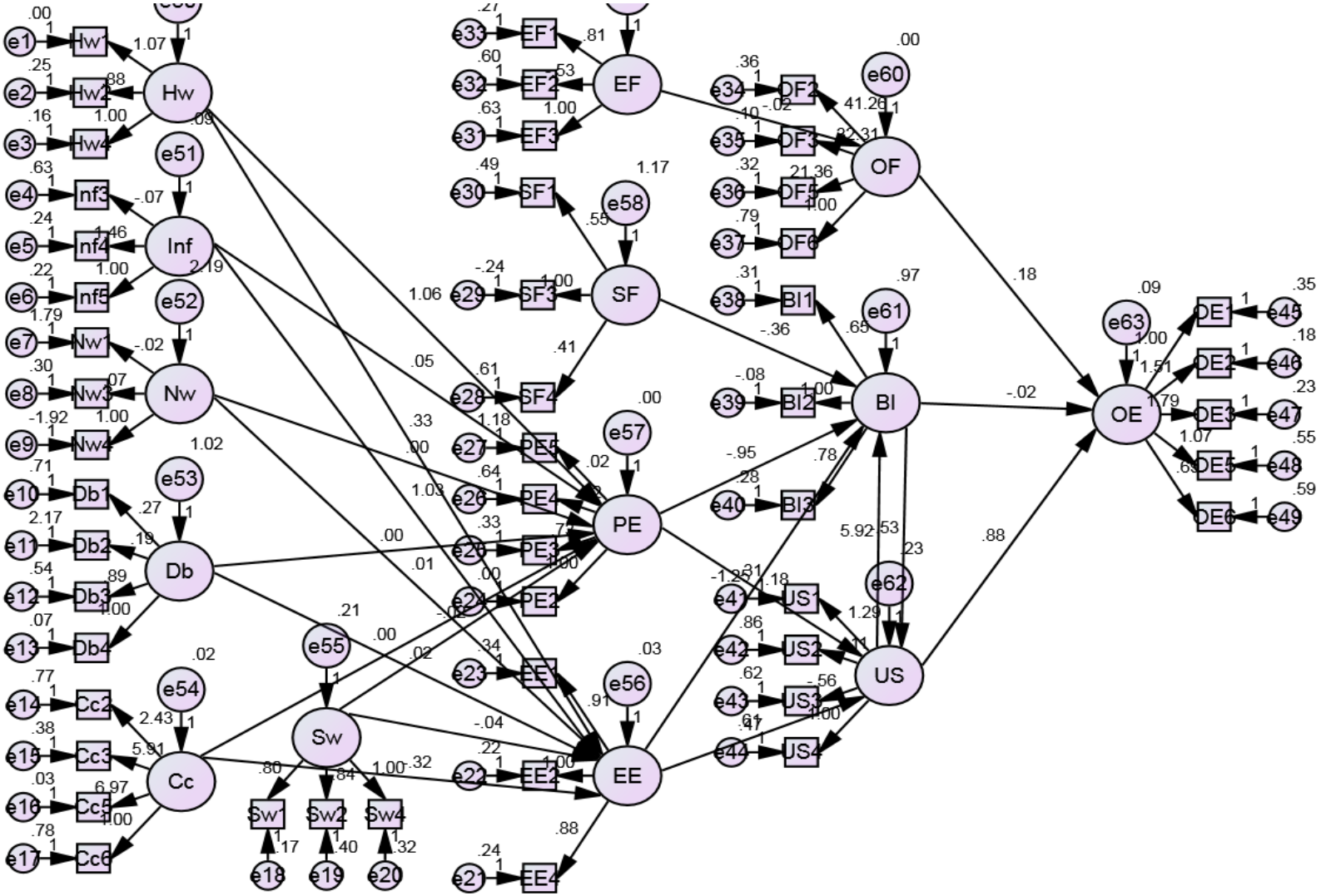

Figure 5.10: Refined structural model

5.8. Testing of Hypotheses

After model fit was achieved, various relationships between unobserved variables were then assessed. Table 5.16 records the standardised significance levels output from AMOS.

Table 5.16: Standardised Significance Levels of Latent Variables

Hypothesis (H)	Regression Path			Estimate	Standard Error	Critical Ratio	P Value	Hypothesis Comment
1a	Effort Experienced	<---	Hardware	0.334	0.054	6.226	***	**Accepted**
1b	Effort Experienced	<---	Software	-0.045	0.074	-0.605	0.545	**Rejected**
1c	Effort Experienced	<---	Network	0.005	0.044	0.123	0.902	**Rejected**
1d	Effort Experienced	<---	Information	1.035	0.215	4.820	***	**Accepted**
1e	Effort Experienced	<---	Database	0.017	0.028	0.624	0.533	**Rejected**
1f	Effort Experienced	<---	Cloud Computing	-.319	0.237	-1.345	.179	**Rejected**
2a	Performance Experienced	<---	Hardware	1.058	0.047	22.737	***	**Accepted**
2b	Performance Experienced	<---	Software	-0.025	0.012	-2.008	0.045	**Accepted**
2c	Performance Experienced	<---	Network	0.002	0.013	0.124	0.901	**Rejected**
2d	Performance Experienced	<---	Information	0.050	0.020	2.549	0.011	**Accepted**
2e	Performance Experienced	<---	Database	-0.001	0.004	-0.153	0.878	**Rejected**
2f	Performance Experienced	<---	Cc Cloud Computing	-0.003	0.031	-0.095	0.924	**Rejected**
3	User Satisfaction	<---	Effort Experienced	0.609	0.259	2.354	0.019	**Accepted**
4	User Satisfaction	<---	Performance Experienced	0.181	0.080	2.269	0.023	**Accepted**
5	Behavioural Intention to continue using	<---	Effort Experienced	-1.246	0.818	-1.523	0.128	**Rejected**

Hypothesis (H)	Regression Path			Estimate	Standard Error	Critical Ratio	P Value	Hypothesis Comment
6	Behavioural Intention to continue using	<---	Performance Experienced	0.181	0.080	2.69	0.023	**Accepted**
7	Overall Evaluation	<---	Organisational Factors	0.175	1.240	0.141	0.888	**Rejected**
8	Organisational Factors	<---	Environmental Factors	-0.023	0.063	-0.364	0.716	**Rejected**
9	Behavioural Intention to continue using	<---	User Satisfaction	5.922	2.329	2.543	0.011	**Accepted**
10	User Satisfaction	<---	Behavioural Intention to continue using	-0.534	0.347	-1.537	0.124	**Rejected**
11	Overall Evaluation	<---	User Satisfaction	0.877	0.243	3.607	***	**Accepted**
12	Overall Evaluation	<---	Behavioural Intention to continue using	-0.024	0.044	-0.560	0.576	**Rejected**
13	Behavioural Intention to continue using	<---	Social Factors	-0.358	0.170	-2.107	0.035	**Accepted**
14a	Organisational Factors	<---	PBK					**Not tested**
14b	Organisational Factors	<---	NPV					**Not tested**

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $\chi 2/d.f = 2.673$; SRMR =0.062

These levels illustrate the hypothesised relationships between constructs which underpin the causal structure for evaluating existing ICTs. The study followed the procedure detailed in Section 4.7.3. For a hypothesis to be accepted, a critical ratio value greater than 1.96 (whether positive or negative) should be obtained. Table 5.16 shows the results of the hypotheses tests. Table 5.16 records that a good number of the hypotheses (H1a, H1d, H2a, H2b, H2d, H3, H4, H6, H9, H11 and H13) had CR values above 1.96, hence were deemed significant.

Their values were: 6.226, 4.820, 22.737, -2.008, 2.549, 2.354, 2.269, 2.269, 2.543, 3.607 and -2.107, respectively. On the other hand, hypotheses H1b, H1c, H1e, H1f, H2c, H2e, H2f, H5, H7, H8, H10, H12, H14a and H14b, were discarded: their critical ratio values were within the range of ±1.96 which is a condition for rejecting a hypothesis. The CR values were: -0.605, 0.123, 0.624, -1.345, 0.124, -0.153, -0.095, -1.523, 0.141, -0.364, -1.537 and -1.537, respectively; except for H14a, and H14b, not included in the SEM analysis.

5.9. Summary

This study sought determining factors which influence the evaluation of existing ICTs. The chapter discussed the frequencies of SME owner characteristics, as well as the descriptive statistics results from SPSS. Descriptive statistics paved the way towards understanding the distribution of the data. Furthermore, CFA results gained from the measurement model outputs were discussed. The measurement model had a poor fit, and it was thus modified. After modification, further testing for goodness of fit, showed that the model did indeed fit well; and thus the final model was drawn up. The chapter then discussed and explained results obtained from testing the hypotheses. The hypotheses were either rejected or accepted, based on their significance value, as suggested by other researchers. The next chapter discusses and reflects upon the implications of the results obtained in this chapter.

CHAPTER 6: IMPLICATIONS OF THE RESULTS

Chapters 1 to 5 discussed the research problem and objective of the study, the literature relating to ICTs, emerging DTs and SMEs, the theoretical foundations, and the conceptual framework which underpinned this study, the methodology followed to describe how the research problem was answered, and the statistical analysis of the data. This chapter will present the synopsis of the research study, and a discussion of the findings and their interpretation with regard to practice. Furthermore, the research objectives and questions are re-examined in relation to the fulfilment of the gap that the research covered.

6.1. Research Overview

This section provides a brief overview of the whole study by summarising what has been discussed in each chapter, sequentially. The primary objective of this study was to develop a framework that could be used by SME owners to evaluate existing ICTs before deciding whether to adopt emerging DTs. The motivation for this research study was that, regardless of many technology adoption studies, there is still a scarcity of studies investigating the evaluation of ICTs already existing before a decision is made to adopt emerging DTs. The majority, if not all, adoption studies emphasise the emerging DTs. The problem the study aimed to solve was the unavailability of a framework that SMEs could use to evaluate their existing ICTs, before deciding whether to adopt emerging DTs. As a way forward, a primary research question was formulated: How can SMEs evaluate their existing ICTs before possibly adopting emerging DTs? The research study deduced the following secondary research questions to answer the principal research question:

1. What are both the financial and non-financial factors relevant to the evaluation of SMEs' existing ICTs before decisions are made on either adopting or rejecting emerging DTs?

2. What are the technological, organisational, individual, and social factors needed in the evaluation of existing ICTs before deciding whether to adopt or reject emerging DTs?
3. Which are the successful financial models that have been used in evaluating ICT investments?
4. How can the determined financial and non-financial factors be integrated into a conceptual framework to inform the effective evaluation of existing *ICTs*? This would help in decision-making apropos of adopting emerging DTs.
5. How can the conceptual framework for evaluation of existing ICTs be validated?

The research went through several phases in which quantitative strategies and methodologies were employed to achieve the study's objective.

Literature on the theoretical concepts of ICTs and emerging DTs was presented in Chapter 2. This included the ICT definition that was adopted and used in this study. Additionally, various ICT components were mentioned and defined. The chapter further discussed the frameworks and models being used by SMEs to evaluate their existing ICTs. This led to the identification of the base as well as supporting models, discussed in detail in Chapter 3. Chapter 3 furthermore discussed IS and the related theoretical frameworks identified in Chapter 2. The ISSM was chosen as the base model that informed this study. The ISSM and other supporting models were discussed and contextualised for this current study, leading to conceptual framework development that provided direction and a path for the study. The research methodologies adopted by this study were presented and discussed in Chapter 4. Chapter 5 reported on the results of data analysis. Data was analysed using frequency, descriptive, and SEM statistical methods.

6.2. Discussion and Implication of Findings in relation to the Hypotheses

Twenty-five relationships were hypothesised (with technological characteristics and FEMs variables broken down into independent hypotheses) as explained in Chapter

3. Fourteen of these hypothesised relationships were rejected; 11 were accepted; and two were not estimated. Implications of these results are deliberated on in the subsequent subsections.

6.2.1 Technological characteristics and effort experience

Hypothesis one (H1) of the study hypothesised that technological characteristics will influence effort experience with the existing ICTs. Technological characteristics were not measured directly, rather through the measuring of the independent components that make up the ICT: software, hardware, network, information, cloud computing, and database. These independent components led to the breakdown of H1 into independent hypotheses, which are:

- H1a: Hardware will influence effort experience.
- H1b: Software will influence effort experience.
- H1c: Network will influence effort experience.
- H1d: Information will influence effort experience.
- H1e: Database will influence effort experience.
- H1f: Cloud computing will influence effort experience.

The study therefore investigated the impact of each of the components on the effort experienced by SME owners with their existing ICTs. Each hypothesis, and the implication of its results, will now be discussed:

H1a: Hardware will influence effort experience.

The results show that H1a was **accepted** (null hypothesis was rejected) which means that hardware influences effort experience. When measuring the effort experienced by SME owners with their existing ICTs, hardware measurements are vital. Hardware measurements determine the effort expended by users on their existing ICTs (Kademeteme and Twinomurinzi, 2019a). Hardware components include: mice, motherboard, Random Access Memory, Central Processing Unit, hard-drive storage, inter alia. The results of this study suggest that such must be focused on in improving

user experience. Hardware components, not only for ICTs, but for any machinery, deteriorate over time. Therefore, as time elapses, the ICT performance deteriorates, thus demanding more effort from the users. Technology users will intend to use ICTs that they believe will improve their job performance (David and Rahim, 2012; Ukut and Krairit, 2019). These studies investigated hardware as an observable variable under the latent variable facilitating conditions (David and Rahim, 2012; Ukut and Krairit, 2019). This study investigated hardware as a latent variable. Management should make sure that proper hardware is in place for better job performance, reducing effort of use of existing ICTs (David and Rahim, 2012; Ukut and Krairit, 2019).

Hardware application tools make administrators' tasks easier and speedier (Ibrahim, Adu-Gyamfi and Kassim, 2018). In the case of academics, lack of resources such as hardware makes it impossible to meet the needs of the students (Ukut and Krairit, 2019). When put into the perspective of this study, lack of proper hardware will require more effort to use existing ICTs, while proper and good hardware will require less effort. SME owners should consider purchasing new hardware components if performance of existing ICT hardware has dropped off.

The results of this study suggest that, when evaluating whether existing ICTs are still useful, one needs to examine the effort required to use the hardware components of such ICTs (Kademeteme and Twinomurinzi, 2019a). If the existing ICT hardware demands too much effort, new hardware components become a necessity. For example, if the existing ICTs have become so slow that users spend a prolonged time waiting for ICTs to respond to commands, purchasing new RAM and CPU should be considered. SME owners should consider replacing a single problematic component, rather than replacing every hardware component, still less discarding the whole ICT.

The compatibility of a system influences its evaluation (Michel-Verkerke and Hoogeboom, 2013). SME owners should therefore consider whether the new hardware components on the market are compatible with their existing ICTs. If they are not, purchasing new hardware will not help. Abandoning the existing ICTs and adopting emerging DTs then becomes viable.

H1b: Software will influence effort experience.

The results obtained by this enquiry show that this hypothesis was **rejected**, meaning the null hypothesis was accepted. This means that software does not influence effort experience. Consequently, when measuring the effort that SME owners put into using existing ICTs, software measurements are not important (Kademeteme and Twinomurinzi, 2019a). Poorly designed GUI integration is the key barrier to the effective use of a system (Fossum, Ehnfors, Fruhling and Ehrenberg, 2011). Interface satisfaction and compatibility are two of the major players in the evaluation of any system (Michel-Verkerke and Hoogeboom, 2013). These findings contradict the results obtained in this study. This could be so because the current study was conducted in the corporate environment, thus targeting the perceptions of SME owners. Other studies, conversely, focused on a system being used in the medical environment. Different results could be obtained should a similar study be conducted within the SME context. The results show that software, in the context of effort experienced, is not important when evaluating existing ICTs.

Software application tools such as Microsoft Office and Educational Management Information Systems assist administrators of institutions with effective and efficient management of information (Hameed and Counsell, 2014). The lack of resources such as good and proper software tools makes it impossible to meet the needs of the students (Ukut and Krairit, 2019). However, in the case of SME owners, this study suggests that software applications do not influence SME owner experience in using existing software (Kademeteme and Twinomurinzi, 2019a).

This result implies that, when evaluating existing ICTs, SME owners should not consider the influence of the software component of existing ICTs on effort experienced by them. Generally, recent developers follow good design practices when developing software components (Peñarroja *et al.*, 2019). End users will face almost the same GUI in the new software as in the old (Peñarroja *et al.*, 2019). Furthermore, purchasing new software is expensive compared with upgrading. The results of the study therefore suggest that SME owners probably prefer the option of upgrading, rather than buying new emerging software. Scarcity of finances could be one of the

reasons for not buying new software, instead upgrading or conducting re-installations. For example, upgrading of software will allow one to obtain the latest drivers for emerging, sophisticated DTs, such as printers.

H1c: Network will influence effort experience.

This hypothesis was **rejected**, meaning the null hypothesis was accepted which is network does therefore not influence effort experience. Network measurements are thus not vital as they do not determine the effort that users put into using existing ICTs. Accessibility plays a role in the evaluation of electronic patient records by health-care professionals (Michel-Verkerke and Hoogeboom, 2013). Accessibility is the extent to which users have access to the system at the time and location the user desires (Michel-Verkerke and Hoogeboom, 2013). This definition of accessibility corresponds with some of the questions in the questionnaire used by this study asking about the network construct. The results of this study however contradict the results obtained by other research studies (Michel-Verkerke and Hoogeboom, 2013). The results of this study suggest that the network is not a factor to consider when SME owners investigate the effort they put into using the network system of the existing ICT.

SMEs do not use a sophisticated network infrastructure (Kabanda and Brown, 2017). Most SMEs still rely on public ICT facilities such as cybercafés, information access points, and telecentres (Kabanda and Brown, 2017). This agrees with the result obtained by this study and other studies, that the network does not affect the effort users put into or experience with their existing ICTs. These results imply that, practically speaking, SME owners would prefer to use less sophisticated network infrastructure than to purchase emerging sophisticated network infrastructure, such as the IoT (Kademeteme and Twinomurinzi, 2019a).

H1d: Information will influence effort experience.

The results of this enquiry indicate that the hypothesis was **accepted** (the null hypothesis was rejected)**.** This means that information influences effort experience. Information measurements are therefore vital when intending to measure the effort

that SME owners put into obtaining the desired information from existing ICTs. Meeting the performance requirements of an ICT user results in high quality of the information and system (DeLone and McLean, 2002). Therefore, if the output (information) gained from the existing ICTs is of high quality, the SME owner will regard the ICTs as high quality. Such will prompt the SME owner to continue with the existing ICTs. Although in other studies (Michel-Verkerke and Hoogeboom, 2013) information quality was not found to be an influencing factor, in this study, as well as in others (Kademeteme and Twinomurinzi, 2019a), information was found to play a role. This result implies that SME owners should consider information dimensions such as: accurateness, timeliness, completeness, relevance, and accessibility of the information, with less effort from the existing ICTs. As long as these dimensions are still being met, the existing ICT is deemed relevant. On the other hand, if not, there is a need to adopt emerging DTs.

H1e: Database will influence effort experience.

The results obtained by this study show that this hypothesis was **rejected.** The null hypothesis which is databases do not influence effort experience was accepted. This result implies that, when intending to measure the effort that SME owners put into using the database of existing ICTs, database measurements are not significant. Databases are used to store organisational data for future access. Generally, SMEs do not generate and consume much data compared with larger companies; hence they will not require sophisticated database-management systems (Wen, 2019).

Larger firms generate and consume more data than smaller ones, thus larger enterprises would require huge databases with greater storage than medium, small, very small, and micro enterprises. Therefore, the results obtained in this study can be relied on. The study's focus was SMEs which do not generate and consume much data. The implication of this result is that SMEs do not see databases or storage space playing an influential role in their decision whether to continue using existing ICTs, or to adopt emerging DTs (Kademeteme and Twinomurinzi, 2019a).

H1f: Cloud computing will influence effort experience.

The results show that the hypothesis was **rejected.** The null hypothesis: cloud computing does not influence effort experience was therefore accepted. When intending to measure the SME owners' effort experience with their existing ICTs, cloud computing measurements are not vital. This result agrees with the result of network and database measurements, as already explained. This result implies that SME owners should not consider cloud-computing services during the evaluation of existing ICTs. Cloud computing can be equated to accessibility, which was found to be a factor in the evaluation of electronic patient records by health-care professionals (Michel-Verkerke and Hoogeboom, 2013). Cloud computing was measured using the following: reliability, speed, security, compatibility, and ease of use. Therefore, the results of this enquiry suggest that the effort users experience when it comes to reliability, speed, security, compatibility, and ease of use of cloud-computing services does not influence evaluation of existing ICTs.

Cloud computing offers services such as access to software, applications, storage space, and more. These services are costly for most SMEs, finance being a universal barrier for SMEs (Mueller and Thomas, 2001; Brink, Cant and Ligthelm, 2003; Maleka and Fatoki, 2016; Osano and Languitone, 2016; Lee, Wong and Hoo, 2017; Naude and Chiweshe, 2017). Therefore, the result obtained in this study that cloud computing is not a factor to consider in the evaluation of existing ICTs, is reliable. Most SMEs might not see cloud computing as a need. They do not require huge storage space which cloud services tend to offer. This agrees with the software and database results for hypotheses H1b and H1e above. Such factors were found to be insignificant. SMEs do not require sophisticated software, and they do not generate and consume large volumes of data (Wen, 2019), warranting use of cloud services. To access cloud computing services, an SME will require networking facilities, also not found as an influential factor in the evaluation of existing ICTs (Kademeteme and Twinomurinzi, 2019a).

6.2.2 Technological characteristics and performance experience

The second hypothesis (H2) of the study suggested that technological characteristics will influence performance experience with the existing ICTs. As with effort experience, the interaction between technological characteristics and performance experience was not measured directly. Measurements were derived through independent components of the ICT: hardware, software, network, information, database, and cloud computing. These independent components led to the breakdown of the main hypothesis into independent hypotheses, namely:

- H2a: Hardware will influence performance experience.
- H2b: Software will influence performance experience.
- H2c: Network will influence performance experience.
- H2d: Information will influence performance experience.
- H2e: Database will influence performance experience.
- H2f: Cloud computing will influence performance experience.

Therefore the study investigated the impact of each of the components on the performance of SME owners. Each hypothesis, and the implication of its results, is discussed below.

H2a: Hardware will influence performance experience.

The results show that the hypothesis was **accepted** (the null hypothesis was rejected)**.** Hardware therefore does influence performance experience. This result implies that hardware measurements are vital in measuring the performance experienced by SME owners when using existing ICTs. When evaluating whether existing ICTs are still useful, SME owners must scrutinise the performance experienced with the hardware components of the existing ICTs. If the existing ICT hardware is not performing well, SME owners will later experience worse trouble with the existing ICTs, leaving them dissatisfied. Therefore, SME owners must evaluate the performance of the existing ICT hardware, to ascertain the existing ICT performance. The specific hardware component causing the ICT to underperform should be investigated. The SME owner may consequently have to replace the specific hardware component, rather than to replace the whole ICT.

The results of this study that hardware components influence the performance experienced by SME owners, are supported by other studies (David and Rahim, 2012; Ukut and Krairit, 2019). Technology users will intend to continue using ICTs that they believe will improve their job performance. Hardware therefore plays a key role (David and Rahim, 2012; Kademeteme and Twinomurinzi, 2019a; Ukut and Krairit, 2019). Top management should ensure that proper hardware be in place for better and increased job performance (David and Rahim, 2012; Kademeteme and Twinomurinzi, 2019a; Ukut and Krairit, 2019). Hardware application tools make administrators' tasks easier and speedier (Ibrahim, Adu-Gyamfi and Kassim, 2018). Lack of hardware resources makes it impossible to meet the needs of the students (Ukut and Krairit, 2019). SME owners will prefer continued use of hardware that will facilitate them in performing their tasks better. Should hardware of existing ICTs appear to have caused poorer performance, SME owners will consider purchasing hardware of emerging DTs to replace that of existing ICTs.

H2b: Software will influence performance experience.

The results show that the hypothesis was **accepted** (the null hypothesis was rejected)**.** Software does therefore influence the performance experienced by users. Therefore, when intending to measure performance of their existing ICTs, performance of software is paramount. Although the results of this study have shown that software does not influence the effort experienced, reliable software is vital when measuring the performance SME owners experienced in using existing ICTs.

Software application tools such as Microsoft Office and Educational Management Information Systems were found to assist administrators of institutions with effective and efficient management of information (Hameed and Counsell, 2014). Lack of good and proper software tools makes it impossible to meet the needs of the students (Ukut and Krairit, 2019). These results, even though found in academic settings, agree with the results obtained in this study in the context of SMEs in South Africa. Software applications range from operating systems such as Windows 7 to application software such as antivirus software and accounting software, for instance Excel. The study did

not consider investigating each type of software (operating system or application software). Rather, it investigated software in general. Therefore, the results obtained in this study suggest that operating systems or application software do influence the performance experienced by SME owners.

Malicious software such as malware, firmware, viruses, worms, Trojans, spyware, adware, and Rootkits, can result in slow performance of the software component of an existing ICT. When SME owners start experiencing slow software performance, their job performance is concomitantly likely to reduce. Owners are likely to spend a considerable amount more time performing and finishing tasks than they used to do. In such cases there is a need to purchase the software component of an emerging DT. Practically speaking, if this is a result of a malicious software such as virus, an upgrade or a purchase of better antivirus software or a backup, format of the ICT and re-installation, would be better than replacing all application software or the operating systems.

If vendor support for the existing operating system becomes unavailable (most vendors stop supporting their old software), an upgrade to or a purchase of emerging operating system must be achieved. Instead of replacing the whole ICT by adopting emerging DTs, the SME owner can simply purchase or upgrade the faulty component, in this case, the software. This will, in turn, result in an SME owner saving money, finance being a challenge for SMEs (Pinsonneault and Kraemer, 1993; Chau, 1995; Kapurubandara and Lawson, 2001; Knol and Stroeken, 2001; Mueller and Thomas, 2001; Duan, Mullins, Hamblin, Stanek, Sroka, Machado and Araujo, 2002; Brink, Cant and Ligthelm, 2003; Singh and Belwal, 2008; Chimucheka and Mandipaka, 2015; Maleka and Fatoki, 2016; Osano and Languitone, 2016; Naude and Chiweshe, 2017). Owners need not purchase the complete emerging DT; rather, the faulty component can be replaced.

H2c: Network will influence performance experience.

The results obtained by this enquiry show that the hypothesis was **rejected;** which means that the null hypothesis: network does not influence performance experience

was accepted. This result implies that, in the experiences of SME owners with the existing ICTs, network measurements are not vital. Tasks performed by SME owners (the sending or receiving of documents or emails across a network) are not network demanding; and thus any type of network will be suitable. Similarly, SMEs generally do not use heavy database-management systems (e.g., SAP, Microsoft SQL, and Oracle) (Wen, 2019) that require big memory (RAM), a rapid network system, and large storage space on hard disks. Therefore networks which can accommodate these, are not necessary.

Most SMEs in Tanzania still rely on public ICT facilities such as information access points, cyber cafés and telecentres, which makes access possible because of the more affordable sharing costs compared to individual ICT ownership and individual network usage fees (Kabanda and Brown, 2017). As much as their study focused on Tanzania, some factors might be common in other developing economies, such as South Africa. Therefore, their results agree with the results obtained in this enquiry that network does not affect the job performance experience of the SME owner. These results imply that SME owners, practically speaking, would prefer to use a less sophisticated network infrastructure than to purchase emerging network infrastructure such as the Internet of Things (IoT), as long as they can still perform their daily duties with ease. SME owners in South Africa do not necessarily view emerging network capabilities such as IoT as important for their job performances.

H2d: Information will influence performance experience.

The results show that the hypothesis H2d was **accepted** (the null hypothesis was rejected)**.** Information does therefore influence performance experience. This result means that information from the existing ICT is vital when measuring the performance experienced by SME owners in using the existing ICT. Information quality influences user satisfaction (DeLone and McLean, 2002). Therefore, when SME owners are evaluating existing ICTs, they should consider the accurateness, timeliness, completeness, relevance, and accessibility of the information that comes from the existing ICT.

SMEs could benefit from providing important channels of information to decision-makers (SME owners in this study) (Musteen, Francis and Datta, 2010). Such information is vital in their decision-making. Information can be in various forms, such as dashboards and reports. Many SMEs, however, still face major challenges and obstacles in obtaining the correct information and effectively managing it to support their decision making processes (Nguyen, Barrett and Fletcher, 2006; Hsu, Chen and Cheng, 2013). The above outcome agrees with the results of this study. Information was found to play a role in the performance that SMEs have experienced with their existing ICTs. This study implies that, from a practical perspective, as long the information (reports and dashboards) from existing ICTs is still accurate, timely, complete, relevant, and accessible for their decision-making, SME owners do not see the need to adopt emerging DTs.

H2e: Database will influence performance experience.

The results show that the hypothesis H2e was **rejected.** The null hypothesis which stated that databases do not influence performance experience was accepted. This result implies that, for the performance experienced by SME owners with existing ICTs, database measurements are not vital. SMEs do not consider databases vital because most do not use heavy database-management systems, such as SAP, Microsoft SQL Server or Oracle. Some do not use databases at all, except for small-application software, such as Excel spreadsheets and MySql (Wen, 2019). Therefore, SMEs which do not generate and consume much data will prefer to use application software, for instance, Microsoft Excel, or QuickBooks.

H2f: Cloud computing will influence performance experience.

The results obtained by this investigation show that the hypothesis was **rejected.** The null hypothesis which stated that cloud computing does not influence performance experience was therefore accepted. This result means that, for the performance of existing ICTs, measuring cloud computing services is not vital. As with cloud computing and effort experience, this result implies that SME owners should not consider cloud computing services when evaluating existing ICTs.

This result agrees with the result of network and database, as already explained. The implication of this result is that SME owners should not consider cloud-computing services during the evaluation of existing ICTs. Cloud computing can be equated to accessibility (Michel-Verkerke and Hoogeboom, 2013). Accessibility was found to be a factor in the evaluation of electronic patient records by health-care professionals (Michel-Verkerke and Hoogeboom, 2013). Cloud computing was measured using the following factors: reliability, speed, security, compatibility, and ease of use. Such factors are all related to accessibility of cloud computing services. Therefore, the results of this enquiry suggest that the performance that users experience with their existing ICTs is not influenced by the reliability, speed, security, compatibility, and ease of use of cloud-computing services.

6.2.3 Effort experience

Effort experience embraced two hypotheses, H3 and H5: effort experience will impact on user satisfaction; and effort experience will impact on behavioural intention to continue using existing ICTs.

H3: Effort experience will impact on user satisfaction with the existing ICTs.

When it comes to effort experience and user satisfaction with the existing ICTs, the results of the study showed that this hypothesis was **accepted** (the null hypothesis was rejected). The study had hypothesised that effort experience would have an impact on user satisfaction. User satisfaction is a key indicator of the decision to abandon any ICT (Sachs and Hale, 2003; Levy, 2007). The results obtained in this study agree with results obtained by Iivari (2005). This researcher ascertained that perceived system quality was a significant direct predictor of user satisfaction. Other authors have referred to system quality in terms of its complexity (Thompson, Higgins and Howell, 1991), while others have referred to it in terms of perceived ease of use (Davis, 1989). Therefore, this result means that the complexity of existing ICTs influences SME owners. Low effort experienced increases user satisfaction. The easier it is to use an ICT, the more likely it is that the SME owner will be satisfied and

continue to use the ICTs rather than adopting emerging DTs (Kaewkitipong, Chen and Ractham, 2016). This agrees with the result of this study: the effort that users have experienced with the existing ICTs play a part in determining user satisfaction. The more complex the existing ICTs, the more effort SME owners have to put into using them, the less satisfied users will be. Such SME owners would then prefer adopting emerging DTs if they anticipate that they would require less effort than existing ICTs (Venkatesh *et al.*, 2003; Venkatesh and Zhang, 2010).

In post-usage circumstances, effort expectancy plays a significant direct role in continued intention to use a system (Venkatesh, Thong, Chan, Hu and Brown, 2011). This finding agrees with the finding of this study which was conducted in the same settings of post-usage of existing ICTs even though this study referred to expectancy as experience. In post-usage settings, users experienced how the system works; and how much effort the system demands. This is unlike in pre-usage settings, where the effort is a feeling of anticipation rather than a reality. The results of this study suggest that, in post-usage settings, low effort experienced by SME owners with their existing ICTs results in higher satisfaction. Such, in turn, is likely to result in continued use of the existing ICTs, rather than adoption of emerging DTs.

The results obtained in this study imply that SME owners will be attracted to, and would prefer continued use of ICTs that are not complex, enabling them to finish the tasks at hand quickly and easily (Zhou, 2014). Generally, these results mean that when SME owners put little effort into the existing ICTs, they will be greatly satisfied. Highly satisfied SME owners will be more willing to continue using existing ICTs.

H5: Effort experience will impact on behavioural intention to continue using the existing ICTs.

The results of this study show that the hypothesis between effort experience and behavioural intention to continue using existing ICTs was **rejected**. Therefore, when evaluating existing ICTs, effort experienced with the existing system does not influence an SME owner's behaviour to continue using the existing ICTs.

The rejection of the hypothesis is contrary to the results obtained by (Venkatesh *et al.* (2003). Effort expectancy is the degree of ease of use of an ICT (Venkatesh *et al.*, 2003). Other researchers referred to effort expectancy as complexity (Thompson, Higgins and Howell, 1991) and perceived ease of use (Davis, 1989). The researchers agreed on the same definition of effort expectancy: the degree to which an ICT user believes that using the ICT would be effortless. The intention to adopt emerging DTs is great if the emerging DTs are touted as easy to use (Davis, 1989; Thompson, Higgins and Howell, 1991; Venkatesh *et al.*, 2003). However, in the circumstances of this study, effort expectancy was equated with effort experience. Such refers to experiences that users have with the existing ICTs. This study therefore suggests that the experiences users have with the existing ICTs do not influence their behavioural actions to continue using the existing ICTs. Even though they investigated emerging mobile payment technology, the results of this study are consistent with the results obtained by the Oliveira *et al.* (2016), and Zhou (2014). The mentioned researchers found effort expectancy not significant in explaining the behavioural intention to adopt mobile payment technology. Researchers (Rana, Dwivedi, Williams and Weerakkody, 2016; Dwivedi *et al.*, 2017; Khalilzadeh, Ozturk and Bilgihan, 2017) also found that effort expectancy did not directly affect behavioural intention.

As time passes, users gain experience with the system (Taylor and Todd, 1995). However, the outcome of this study suggests that the experience gained by SME owners in using their organisation's existing ICTs does not affect the evaluation of those existing ICTs. The results of this investigation prove the propositions made by Venkatesh *et al.* (2003), Venkatesh and Zhang (2010), and El-Masri and Tarhini (2017). The influence of effort expectancy decreases with ICT experience, resulting in effort expectancy being less significant as experience with the existing ICTs increases (Venkatesh *et al.*, 2003; Venkatesh and Zhang, 2010). The same result was supported by a study conducted by El-Masri and Tarhini (2017). These researchers found that the effect of effort expectancy for experienced USA students was insignificant compared with less experienced Qatar students in adoption of an e-learning system. This supports the result obtained in this study that effort experience will not influence users' perceptions of existing ICTs.

This result implies that small and medium-sized business owners should not base their decisions on the effort experiences they have gained to continue using existing ICTs. The experiences may lead them to believe that the emerging DTs are better than the existing ICTs, or vice versa. The performance of existing ICTs therefore matters more than how much experience users have gained with existing ICTs. The results imply that, regardless of the effort experienced in using the existing ICTs, if the SME owner does not see the qualities and advantages associated with the existing ICTs, the SME owner may not be willing to continue using the existing ICTs. SME owners who are more innovative, will be more inclined towards adopting emerging DTs. For such, the effort they have experienced is not of importance in determining whether to adopt emerging DTs, or to continue using existing ICTs.

6.2.4 Performance experience

Effort experience had two hypotheses, H4 and H6: Performance experience will impact on user satisfaction; and performance experience will impact on behavioural intention to continue using existing ICTs.

H4: Performance experience will impact on user satisfaction with the existing ICTs.

The results of the study showed that this hypothesis was **accepted** (the null hypothesis was rejected). These results agree with the results obtained by Iivari (2005), who found perceived system quality to be a significant direct predictor of user satisfaction. As with effort experience, performance experience was found to determine the satisfaction of users. As mentioned before, user satisfaction is a key indicator of the decision to abandon any ICT (Sachs and Hale, 2003; Levy, 2007). Satisfied SME owners will favour continued use of existing ICTs, while dissatisfied SME owners will favour adoption of emerging DTs.

The effect of perceived usefulness or performance expectancy on user satisfaction has been proven in various IT contexts (Mahmood *et al.*, 2000; Bhattacherjee, 2001; Kaewkitipong, Chen and Ractham, 2016); such also held true in this context.

Perceived usefulness, analogous of performance expectancy (Venkatesh *et al.*, 2003), and of performance experience in this current study, plays a significant direct role towards intention to continue to use in a post-usage context. Such is also the context of this study. In post-usage settings, users have experienced the good and/or bad performance of the existing ICTs. Thus, high performance levels experienced by SME owners in their existing ICTs lead to higher levels of satisfaction. Such, in turn, will likely result in continued use of the existing ICTs, rather than adoption of emerging DTs.

High performance of existing ICTs will enhance SME owners' jobs and duties; hence there will be no need for SME owners to adopt emerging DTs. Existing ICTs are still capable of accomplishing SME owner tasks and duties. In practice, this result means that SME owners should continue to explore and take advantage of all the performance capabilities of the existing ICTs. This will likely result in satisfaction of SME owners with the existing ICTs. Such will, in turn, enforce continued use of existing ICTs. When the performance of existing ICTs is high, and meets the expected standard, SME owners will be greatly satisfied (Kademeteme and Twinomurinzi, 2019a). When they are greatly satisfied, their intention to continue using existing ICTs will increase (Kademeteme and Twinomurinzi, 2019a). In practice, users are generally attracted to, and prefer continual usage of ICTs which perform well. The inference of this result is that SMEs should consider the satisfaction of SME owners with the performance of the existing ICTs, when evaluating those ICTs.

H6: Performance experience will impact on behavioural intention to continue using the existing ICTs.

The results of this study have shown that the hypothesis was **accepted** (the null hypothesis was rejected)**.** Therefore the performance SMEs experienced with the existing ICTs does influence their behaviour to continue using the said ICTs. This construct was derived from performance expectancy (Venkatesh *et al.*, 2003), perceived usefulness (Davis, 1989), and job-fit (Thompson, Higgins and Howell, 1991). These researchers all defined this construct as the degree to which users believe that engaging emerging DTs will smooth their work processes, or aid job

performance. When it comes to the performance that users experienced with existing ICTs, performance experience was defined as the degree to which users believe that using existing ICTs will smooth their work processes or help them attain gains in job performance.

The greatest and strongest predictor of intention is performance expectancy, and is significant for both mandatory and voluntary usage (Venkatesh *et al.*, 2003), which agrees with the results of this study. Voluntary usage was the focus of this study. SME owners hold the highest position, and can thus decide whether to continue using existing ICTs. These results suggest that the performance experienced by SME owners, under voluntary usage circumstances, influences their intention to continue using existing ICTs. Furthermore, the result obtained by Carlsson *et al.* (2006), which states that existing ICTs performance is a predictor of behavioural intention, agrees with the results obtained in this study. Again, from the ISSM perspective, the results agree with those obtained by Iivari (2005). This researcher ascertained that perceived system quality was a significant direct predictor of user satisfaction.

Performance expectations have a direct and indirect significant effect on mobile payment adoption, and the intention to recommend this technology (Oliveira *et al.*, 2016). When the performance of any ICT is impressive, users are highly likely to adopt the ICT (Venkatesh *et al.*, 2003) and recommend that their colleagues or SME owner friends also adopt it. Having experienced good performance of existing ICTs, SME owners are highly likely to continue to use them and to recommend such to their friends and colleagues. Improved performance can capture the attention of SME owners anywhere, at any time, strengthening the continued use of existing ICTs (Oliveira *et al.*, 2016). The degree to which an ICT may prove useful and beneficial to the users influences the intention of the SME owner to either continue using the existing ICTs or to adopt emerging DTs (Dwivedi *et al.*, 2017). People form intentions towards behaviour that they believe will enhance their job performance (Davis, Bagozzi and Warshaw, 1989; Kademeteme and Twinomurinzi, 2019a).

This implies that SME owners should consider whether the ICTs they are currently using are still performing efficiently. If so, they should continue to use existing ICTs;

otherwise, emerging DTs should be adopted. Good performance of existing ICTs will enhance SME owners' jobs and duties. There will then be no need to adopt emerging DTs, since existing ones are still capable of accomplishing SME owner tasks and duties. In practice, system supporters within or outside (vendors) of the organisation should nurture a positive perception on the usefulness of the existing ICTs.

6.2.5 Organisational factors

The seventh hypothesis (H7) of the study investigated the direct impact of organisational factors on the evaluation of existing ICTs.

H7: Organisational factors will directly influence evaluation of existing ICTs.

The results obtained show that this hypothesis was **rejected.** Organisational factors therefore have no influence on the overall evaluation of existing ICTs. Empirical evidence in support of this finding is unanimous (Thompson, Higgins and Howell, 1991; Roode, 1993; Taylor and Todd, 1995; Cheung, Chang and Lai, 2000; Mathieson, Peacock and Chin, 2001; Flanagan and Jacobsen, 2003; Venkatesh *et al.*, 2003; Pynoo, Devolder, Tondeur, Van Braak, Duyck and Duyck, 2011; Oliveira *et al.*, 2016; Peñarroja *et al.*, 2019). These researchers conducted their investigations on the adoption of emerging DTs. This study evaluated existing ICTs. The mentioned research studies referred to their construct as facilitating conditions. In this study, facilitating conditions were referred to as organisational factors.

Facilitating conditions, analogous with organisational factors in this study, is the degree to which the SME owner believes that there is sufficient organisational and technical infrastructure to support the use of existing ICTs (Venkatesh et al., 2003). Facilitating conditions was found to be the underlying factor which play a role in the decision by citizens to use e-government services in Turkey (Kurfalı, Arifoğlu, Tokdemir and Paçin, 2017). Several studies (Zhou, Lu and Wang, 2010; Yu, 2012; Miltgen, Popovič and Oliveira, 2013; Catherine, Geofrey, Moya and Aballo, 2018; Peñarroja *et al.*, 2019) have associated effective and continued use of ICTs with continuous support. Support has been provided through measures such as specialised

instruction, promotional activities, consulting staff, training, incentives, etc. Organisational intervention in the use of existing ICTs results in effectiveness (Peñarroja *et al.*, 2019). However, the results obtained in this study suggest that the existence of organisational factors does not influence the evaluation of existing ICTs. As much as there exist many studies that disagree with this result, there are some studies offering results consistent with the ones obtained by this study. See the studies by Im, Hong and Kang (2011), Baptista and Oliveira (2015), and Peñarroja *et al.* (2019). Even recent studies (Peñarroja *et al.*, 2019) have found facilitating conditions (organisational factors) not to influence behavioural intention to use. The researchers attributed this to the advancement of technology interfaces in terms of usability. Such reduces the need for continued training and support to facilitate continued use.

The implication of this result is that it is not important for SME owners to consider factors such as availability of infrastructure, support or cost of emerging DTs, when they intend to evaluate existing ICTs. Such factors do not impact the evaluation of existing ICTs. The results regarding organisational factors, as obtained in this study, are acceptable. Firstly, there will be no need to train users, that is, SME owners, on their use of existing ICTs, as they have used the ICTs for some time, and are therefore now aware of most avenues around the existing ICTs. Secondly, because user-friendliness of ICTs has, of late, become a common feature and characteristic for most ICTs (Peñarroja *et al.*, 2019), there is no need to train and provide continuous support to SME owners. Owners can easily learn the ICTs with little effort. User-friendly interfaces require less effort (Hur, Kim and Kim, 2014). Therefore, SME owners need to consider other vital factors, like performance of existing ICTs, not only focusing on financial implications, training, and other related organisational factors.

6.2.6 Environmental factors

The eighth hypothesis (H8) of the study was that environmental factors will impact on organisational factors.

H8: Environmental factors will impact on organisational factors.

The results obtained by this study show that the hypothesis was **rejected.** This means that null hypothesis, environmental factors do not influence the organisation was accepted. Competitiveness as an environmental factor, does not play a role in SME owners' decision to adopt ICTs (Thong and Yap, 1995; Kademeteme and Twinomurinzi, 2019a). Even though their research study focused on emerging DTs, the results obtained in this current study demonstrated that this was also the case with evaluation of existing ICTs before possibly adopting emerging DTs. Furthermore, Fink (1998) posited that external factors such as external support, do not impact adoption of technology. This agrees with the results of this study which affirmed that the external forces exerted on SME owners by the environment would not influence their decision to continue using existing ICTs, or to adopt emerging DTs. As much as there are other studies that agreed with the result obtained in this study, other researchers, such as Awa and Ojiabo (2016), noted that trading partners' readiness, competitive pressure, socio-cultural issues, ICT support infrastructures (such as quality ICT consulting services), and government support are pertinent factors for use of ICTs in SMEs.

This result implies that SME owners should not be influenced by the competition in the environment either to adopt emerging DTs, or to continue using existing ICTs. Owners should rather focus on other factors, such as the performance of existing ICTs. As long as the existing ICTs are still useful and profitable, SME owners should continue with existing ICTs rather than adopting emerging DTs, regardless of their existence on the market. As much as any organisation cannot operate in isolation without the influence of other organisations and fellow competitors, the results of this study seem to suggest otherwise. Competitors might have an influence on the organisation in other aspects but not in the aspect of evaluation of existing ICTs. Practically speaking, SME owners should not compete with their fellow SME owners in terms of adoption of emerging DTs. Rather, owners should look at their capability of handling the rate of technology evolution, otherwise they risk extinction.

6.2.7 User satisfaction

User satisfaction with existing ICTs relates to two hypotheses (H9 and H11), namely: user satisfaction will impact intention to continue using existing ICTs; and user satisfaction will influence evaluation of existing ICTs.

H9: SME-owner satisfaction will influence behaviour to continue using the existing ICTs.

The results obtained by this study show that the hypothesis was **accepted** (the null hypothesis was rejected)**.** Such means that the SME owner satisfaction with the existing ICTs will affect behavioural intention to continue using those existing ICTs. Users who are more satisfied with the existing ICTs are likely to use them more (Fishbein and Ajzen, 1975; Baroudi, Olson and Ives, 1986; Iivari, 2005; Kademeteme and Twinomurinzi, 2019a). Behavioural intention to continue using existing ICTs will therefore increase. The results obtained in this study support that SME owner satisfaction will impact behavioural intention to continue using existing ICTs, rather than vice versa. SME owner satisfaction mediates the quality / behavioural intention relationship (DeLone and McLean, 2002; Delone and McLean, 2003; Ahmed, Nawaz, Usman, Shaukat and Ahmed, 2010; Kademeteme and Twinomurinzi, 2019a) which supports the results obtained in this study.

The implications of these results are that an SME should consider the satisfaction of the SME owner, thus whether they are happy with the performance, or output, of the existing ICTs. As long as they are satisfied, the ICTs will be used.

H11: SME-owner satisfaction will influence the evaluation of the existing ICTs.

The results obtained by this study show that hypothesis H11 was **accepted** (the null hypothesis was rejected)**.** SME owner satisfaction with the existing ICTs will therefore impact overall evaluation. SME owner satisfaction has a strong impact on individual actions (DeLone and McLean, 2002; Delone and McLean, 2003; Iivari, 2005; Kademeteme and Twinomurinzi, 2019a). This result implies that SME owners should consider the satisfaction of users when evaluating existing ICTs. SME owners' satisfaction directly impacts on the overall existing ICT evaluation.

6.2.8 Behavioural intention to continue using

Behavioural intention to continue using existing ICTs was associated with two hypotheses (H10 and H12), namely: behavioural intention to continue using existing ICTs will have an influence on user satisfaction; and behavioural intention to continue using existing ICTs will influence existing ICT evaluation.

H10: SME-owner behaviour to continue using the existing ICTs will influence their consequent satisfaction with existing ICTs.

The results obtained by this research study show that hypothesis H10 was **rejected.** Intention to continue using existing ICTs does therefore not drive satisfaction of the SME owner. Behavioural intention to use existing ICTs was not found to have an influence on user satisfaction (Kademeteme and Twinomurinzi, 2019a). Rather, user satisfaction will influence continued use of ICTs (Baroudi, Olson and Ives, 1986; DeLone and McLean, 2002; Delone and McLean, 2003). The results obtained in this study are acceptable. Continued use of ICTs does not necessarily mean that the user is satisfied with the ICTs. Rather, they could be using them because they have run out of options. Therefore, the implications of these results are that the continued use of existing ICTs should not be considered a factor in measuring SME-owner satisfaction with existing ICTs.

The results obtained in this study are inconsistent with the results obtained by various previous studies (Anandarajan, Igbaria and Anakwe, 2002; Daud Norzaidi and Intan Salwani, 2009; Khayun and Ractham, 2011; Hou, 2012; Isaac *et al.*, 2017). Such researchers explained that, when Internet usage increases among employees within government institutions, this leads to an increase in employee satisfaction. However, the results of this study seem to suggest otherwise − that intention to continue using existing ICTs does not result in user satisfaction. Practically speaking, these results suggest that SME owners should not measure their intention to continue using existing ICTs as a direct source of their satisfaction.

H12: SME-owner behaviour to continue using the existing ICTs will influence the evaluation of those ICTs.

The results show that hypothesis H12 was **rejected.** Intentions to continue using existing ICTs do not affect the overall evaluation of those existing ICTs. This result is consistent with the study by Kademeteme and Twinomurinzi (2019a) and Iivari (2005), who did not find behaviour to continue using existing ICTs to have an influence on evaluation of those existing ITCs. The influence of actual ICT use on the dependent variable 'individual impact' was insignificant (Iivari, 2005). However, this result contradicts those of Venkatesh *et al.* (2003). This researcher stated that adoption of emerging DTs and their subsequent use are driven by positive behaviour. This was not found to be the case, however, in relation to the continued use of existing ICTs. Furthermore, this result contradicts that obtained by Carlsson *et al.* (2006). These researchers ascertained that behavioural intention has a positive impact on actual usage of ICTs. However, when evaluating existing ICTs, SME owners must put aside their personal opinions, and consider the real facts, such as actual performance.

Even though this result contradicts results validated by other researchers (Davis, 1989; Venkatesh *et al.*, 2003; Tibenderana and Ogao, 2008), the results of this study are valuable and reliable. The results of this study show that SME owners must consider other important factors, besides their intentions, when evaluating existing ICTs. The implication of this result is that the intention to continue to use existing ICTs may be driven by performance of those ICTs. However, these factors may not be useful when evaluating the existing ICTs.

6.2.9 Social Factors

Social factors were hypothesised to influence behavioural intention to continue using existing ICTs. The hypothesis stated that;

H13: Social factors will impact on behavioural intention to continue using existing ICTs.

The results obtained in this study show that the hypothesis was **accepted** (the null hypothesis was rejected)**.** Social factors therefore do indeed have an influence on individual SME owners' behaviour in continuing to use existing ICTs. When technology is adopted on a voluntary basis , social influences have no direct effect on intention (Davis, 1989; Mathieson, 1991; Lu, Yao and Yu, 2005). This conclusion contradicts the results of this study. An SME owner has the power of either continuing to use existing ICTs or adopting emerging DTs. Therefore the continued use of existing ICTs is thus not mandatory but voluntary. Lu, Yao and Yu (2005) investigated social influence in technology adoption. This research study, however, investigated social influence in evaluating existing ICTs. Such presents a different scenario. Hence, it is not abnormal to yield different results. Furthermore, in technology adoption, users are hesitant to ask and/or be influenced by colleagues, friends, and family. However, when evaluating existing ICTs, the SME owner would likely ask colleagues, friends, and family, who have also experienced the emerging DTs. Owners would want to know whether the emerging DTs are worth adopting. There is thus a higher possibility that SME owners would be influenced by these individuals.

The degree to which an ICT user perceives that people important to them believe they should use ICT is social influence (Venkatesh *et al.*, 2003, Venkatesh, Brown, Maruping and Bala, 2008). Social influence covers the processes that determine an individual's commitment, or psychological tendency towards any new emerging DTs (Malhotra and Galletta, 1999). Social influence reflects the weight that one places on the views of external others regarding use of technology (Maruping, Bala, Venkatesh and Brown, 2017). Some SME owners acknowledge 'SF' as a supporting factor influencing behavioural intention to continue using existing ICTs. The SME owner has the ultimate power to decide whether to continue using existing ICTs. Such a commitment by the SME owner contributes towards the evaluation of existing ICTs.

Social factors play a part when it comes to the use of technology (Thompson, Higgins and Howell, 1991; Taylor and Todd, 1995; Malhotra and Galletta, 1999; Venkatesh and Morris, 2000; Venkatesh and Davis, 2000; Ditsa, 2003; Venkatesh *et al.*, 2003; Wang and Butler, 2007; Kalema, 2013b, 2013a; Tosuntaş, Karadağ and Orhan, 2015; Nikou and Economides, 2017; Kademeteme and Twinomurinzi, 2019a). Such agrees

with the results of this study. Social factors are significant in mandatory rather than voluntary settings (Venkatesh *et al.*, 2003). However, social influence also becomes irrelevant even in mandatory settings as continued use of existing ICTs becomes voluntary rather than mandatory (Venkatesh *et al.*, 2003). However, such applies when users have been dictated to by their superiors apropos of what to use and what not to use. The SME owner, however, has no superior to coerce any particular use. Therefore, the use of existing ICTs is voluntary from start to finish of the life cycle of the project. SME owners should therefore consult with other people important to them within or outside their organisation to see if their existing ICTs are still useful. However, this study suggests that social factors play a part. This study therefore concluded that social factors play an important role in the evaluation of existing ICTs even in voluntary settings, the only difference being the type of user or the circumstances.

This implies that SME owners should consult with other people important to them who have used the same ICTs as the ones they are currently using to determine whether they should continue to use the existing ICTs. The result also implies that people who were important to the SME owner deemed the continued use of existing ICTs necessary. The SME owners see social influence as an advantage in evaluating their existing ICTs as people important to them will provide useful insights about the value of their existing ICTs.

6.2.10 Financial Evaluation Models (FEMs)

Concerning financial evaluation models, the study hypothesised that FEMs would affect organisational factors in the SME evaluation of existing ICTs before they decide whether to adopt emerging DTs. However, this hypothesis was split into two hypotheses (H14a and H14b) which related to NPV and PBK, respectively. During the literature review, amongst the vast number of financial evaluation models available, the study identified only two financial models mostly used and recommended for the evaluation of an investment. The study, with the help of literature, therefore decided on using net present value (NPV), and the payback period (PBK). Hence, the study hypothesised that NPV and PBK will independently impact on organisational factors.

H14a: NPV will impact on organisational factors.

The study did not include NPV values in CFA. All NPV values computed in this study were positive, which resulted in a recoded NPV with the option '1' only which represented positive values. On the other hand, option '2', representing negative values, was not represented at all. Such an uneven representation of data leads to distorted results, or an unidentified model during confirmatory analysis. Therefore, the hypothesis comparing NPV and organisational factors could not be analysed and/or evaluated.

All the positive NPV values obtained in this study meant that the existing ICTs in the organisation still had the potential to generate cash inflow (profits) (Žižlavský, 2014). ICTs that have a positive NPV value encourage SME owners to continue using them (Žižlavský, 2014). The decision-maker should invest in the project if its NPV is positive, as it could potentially generate more income (Magni, 2005; San Ong and Thum, 2013). A negative NPV, however, shows that the investment is likely to drain cash. SME owners should thus not invest in such. In the context of this study, SME owners will not continue with use of the existing ICTs. The result of this study therefore means that SME owners who participated in this study still have ICTs which are competitive. They therefore do not need to consider adopting emerging DTs.

H14b: PBK will impact on organisational factors.

As mentioned earlier, the study hypothesised that PBK will influence organisational factors in the evaluation of existing ICTs by SMEs. The study intended to use PBK and NPV as observable variables, for the latent variable FEMs during CFA. However, this was not possible. The study concluded that NPV could not be used, leaving FEMs with one observable variable (namely PBK). Consequently, PBK could also not be used in CFA, it being the only observable variable left for FEMs. A minimum of two observable variables should be present for a latent variable to be included in CFA (Gobo, 2004; Kline, 2005; Hair *et al.*, 2006). Three or more observable variables would yield better results. Therefore, PBK was not included, it being the only observable variable under FEMs. This resulted in the exclusion of FEMs in conducting CFA.

Looking at the statistical values obtained for PBK, the results show that, in the first 3 months of the purchase, the majority of SMEs (80.2%) retained their initial capital used to invest in new ICTs. This implies that their existing ICTs have been a good investment and probably a good investment for the future. The expectation is that SME owners would prefer continued use of ICTs which still have the potential to generate more cash-inflow. A faster pay-back period likely means more potential profit. This result implies that SME owners who have participated in this study still see their ICTs as profitable, so there is no need for emerging DTs to be adopted.

The implication of the FEMs result is that studies of this nature should ideally consider three or more financial evaluation models. Should one will be eliminated, more will remain that could be used during CFA.

6.3. The Modified Research Framework

The analyses of the individual hypotheses are depicted in Table 5.16. Thereafter, the study modified the conceptual framework which underpinned this study (as per Figure 3.2) to include only the supported hypotheses. From the analysis of the hypotheses, the relationships between constructs found to be insignificant were eliminated. Falling into this group are: (H1b) effort experience and software; (H1c) network and effort experience; (H1e) database and effort experience; (H1f) cloud computing and effort experience; (H2c) network and performance experience; (H2e) database and performance experience; (H2f) cloud computing and performance experience; (H5) hypothesis on effort experience and behavioural intention to continue using; (H7) organisational factors and existing ICT evaluation; (H8) environmental factors and organisational factor; (H10) behavioural intention to continue using and user satisfaction; and (H12) behavioural intention to continue using and existing ICT evaluation. Hypotheses H14a and H14b were not necessarily insignificant, but they were not included in the SEM analysis. These factors were therefore not included in the final model. Figure 6.1 shows the amended framework.

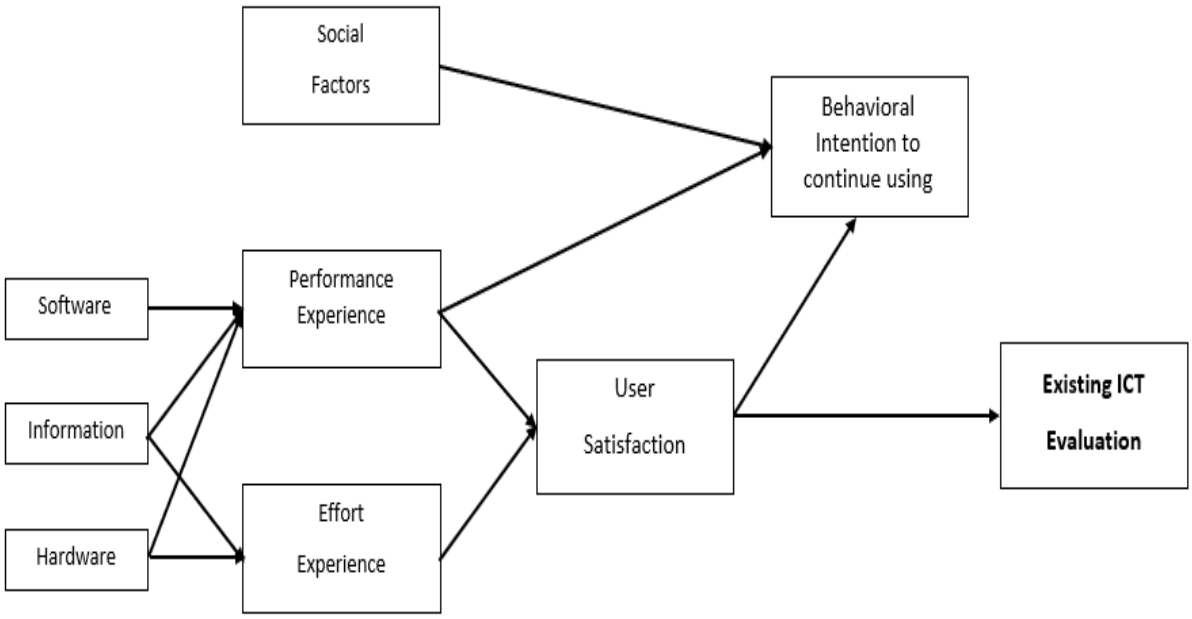

Figure 6.1: Validated existing ICTs evaluation framework

The existing ICTs evaluation framework developed in this study is set to act as a guideline for SMEs and other organisations that intend to evaluate their existing ICTs before adopting emerging DTs. It is apparent that the developed framework agrees with literature on technical characteristics and individual factors that are significant in evaluating existing ICTs.

6.4. Summary

The chapter revisited the research objectives and questions of the study. It is evident that both the major objectives and sub-objectives, of the study were met. The chapter further discussed the results obtained during the analysis in light of the existing literature and practice. The chapter also detailed the implications of the results obtained by this enquiry in relation to the hypothesised relationships between the constructs. From the results, it is also evident that the research questions set at the beginning of this study were answered. The next chapter will show how the research questions were answered. Furthermore, the next chapter will summarise the whole thesis, draw conclusions, and elaborate on future research recommendations.

CHAPTER 7: RESEARCH SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Chapters 1 to 6 discussed the research problem, objectives, literature relating to ICTs and SMEs, theoretical foundations and framework which underpinned this study, the methodology which guided the research, the results obtained from the analysis of data, as well as their discussion and implications. This chapter presents an evaluation of the study by suggesting the contributions the research makes, the scope coverage, and the limitations encountered by the study. The research contributions are presented in the following manner: theoretical, followed by practical contributions. In addition, recommendations for future research are made. The chapter concludes with a summary of the research study in its entirety.

7.1. Introduction

This study sought to develop a framework that SME owners could use to evaluate existing ICTs before deciding whether to adopt emerging DTs. Literature revealed that existing theories do not sufficiently evaluate existing ICTs, focusing solely on the adoption of emerging DTs. Previous theories investigated the anticipated and/or expected value of the emerging DTs without taking into consideration the experiences and/or value acquired by use of existing ICTs. Literature further revealed that some ICT users, or organisations, only evaluated ICTs in terms of their financial impact. Therefore, this study proposed that, before attempting to adopt any emerging DTs, SME owners should consider evaluating existing ICTs to determine whether they are still of value. Such an evaluation would assist SME owners in deciding whether to continue using existing ICTs or whether to adopt emerging DTs. To successfully address the ‘What?’ and ‘How?’ questions posed by this study, the study identified factors from literature which drive the evaluation of both the financial and non-financial dimensions of existing ICTs. The literature review led to the identification of financial models and non-financial factors which may drive the evaluation of existing ICTs. The study then structured and triangulated the identified factors into a conceptual framework which was used to underpin and inform the study. Identified factors were

categorised into several broad groupings, including: SME owners' perceptions, organisational, environmental, ICT characteristics, and financial models. Therefore, in answering the 'What?' and 'How?' questions governing the study, a conceptual framework was developed which was to be tested and validated at a later stage.

Guided by a positivist philosophy, the study consequently collected and analysed data obtained from SME owners. SEM was used to investigate the relevant factors for the evaluation of existing ICTs. SEM was chosen for its ability to compare covariance, identifying the best-fit model, and validating the model. The supporting hypotheses were absorbed into the final framework, whilst the rejected hypotheses were excluded, thereby validating the framework. Chapter 6 addressed the 'Why?' research component, thus affording insight into why some hypotheses were rejected and others accepted. The subsequent section aims to discuss each research question and how it was answered.

7.2. Secondary Research Questions

Secondary Research Question 1 asked:

What are both the financial and non-financial factors relevant to the evaluation of SMEs' existing ICTs before decisions are made on either adopting or rejecting emerging DTs?

To answer Research Question 1, the research study reviewed literature related to SMEs' evaluation of existing ICTs. Chapters 2 and 3 documented the literature review and theoretical foundations, respectively. The literature reviewed included books, journal articles, peer-reviewed conference papers, and White papers. Firstly, the study reviewed literature which provided an understanding of SMEs within the South Africa context, as well as the challenges they face. Secondly, the study reviewed literature which informed the identification of components that make up an ICT. These components were then investigated separately, because an ICT artefact should not be viewed as a stand-alone entity, but rather seen in terms of the independent components which make up the ICT, and the social and environmental factors that

surround that ICT (Orlikowski and Iacono, 2001; Whitman and Mattord, 2012; Bidgoli, 2017).

The study then reviewed literature which revealed how SMEs were currently evaluating existing ICTs. The study endeavoured to explore, from literature, the frameworks, models, and tools currently used by SMEs to evaluate existing ICTs. The study ascertained that SMEs generally employ inadequate financial models to evaluate ICT investments, technology adoption, usage, and acceptance models to evaluate emerging DTs. The study consequently employed these models to identify factors which could then be used to develop an integrated conceptual framework to assist SMEs in the evaluation of existing ICTs. ISSM was used as the base model. Thereafter the study reviewed other prominent theories (including the UTAUT, TAM, and TPB) to identify the relevant non-financial factors. Literature suggested that SME owner satisfaction will play a significant role in the evaluation of existing ICTs. Other non-financial factors found to be relevant in determining the satisfaction level of the SME owner, thereby assisting in the evaluation of existing ICTs, were: effort experienced, performance experienced, behavioural intentions, social factors, organisational factors, environmental factors, and technological factors, including hardware, software, information, database, network, and cloud computing. In an effort to investigate the financial context, the study selected from a pool of financial models, Net Present Value and Pay Back Period, as the most relevant models.

Secondary Research Question 2 asked:

What are the technological, organisational, individual, and social factors needed in the evaluation of existing ICTs before deciding whether to adopt or reject emerging DTs?

The factors identified by answering Secondary Research Question 1 were categorised, based on literature, into: financial models, and technological, individual, organisational, social, and environmental factors. ICT components were classified as technological characteristics. Table 7.1 presents this summary.

Table 7.1: Categorised Factors that Influence Evaluation of Existing ICTs

Factor	Construct
• Hardware • Software • Information • Network • Database • Cloud Computing	Technological characteristics
• Effort experience • Performance experience • User Satisfaction • Behavioural intention to continue using	Individual
• Social Factors	Social Factors
• Environmental Factors	Environmental Factors
• Organisational Factors	Organisational Factors

Secondary Research Question 3 asked:

Which are the successful financial models that have been used in evaluating ICT investments?

In an effort to answer part of Research Objective 1, the study addressed Research Question 3. The identified financial models, as garnered from Research Objective 1, were subjected to scrutiny, in order to identify the financial models most commonly used in practice. As indicated in Chapter 3, literature revealed six possible financial models (ROI, ARR, PBK, NPV, IRR, and ROV). As each model has certain shortfalls, literature suggested that at least two models be used to evaluate a single ICT investment. Each could then augment the other's limitations. The most common and trusted financial models were found to be PBK and NPV. This study therefore adopted and used NPV and PBK financial models to assess the financial value of existing ICTs, thus addressing Research Question 3.

Secondary Research Question 4 asked:

How can the determined financial and non-financial factors be integrated into a conceptual framework to inform the effective evaluation of existing ICTs?

The factors identified and categorised in an attempt to answer research question 2 were then triangulated and structured into a conceptual framework that informed this research study. The hypotheses and relationships between these factors were deduced from literature. Such were then, in turn, used to triangulate and draw a hierarchical structural arrangement, as per Figure 3.2.

Secondary Research Question 5 asked:

How can the conceptual framework for evaluation of existing ICTs be validated?

Using a positivism methodological approach, the study developed an online survey questionnaire which was used to gather data. The instrument was developed through operationalising the identified factors. Reference was made to the original work of the researcher/s who came up with the constructs. This was to operationalise the constructs used in this study. However, care was taken to rephrase the construct items and questions to suit and contextualise these constructs and questions for this research study. CFA was used to analyse gathered data, and to deduce supported hypotheses and factors. SEM was used to validate the conceptual framework, or measurement model, which was initially developed in Chapter 3, using the data collected. SEM was also used to identify factors which influenced the evaluation of existing ICTs. Attributes and factors deemed insignificant were deleted from the structural model. The final validated framework was presented in Figure 6.1. The following factors were deemed necessary in the evaluation of existing ICTs: Hardware, software, information, social factors, user satisfaction, behavioural intention to continue using existing ICTs, performance, and effort experience. The following subsections detail a top-level conclusion summary of both significant and insignificant factors.

7.3. The Primary Research Question

The primary objective of this study was to develop a framework that could be used by SME owners to evaluate existing ICTs before adopting emerging DTs. The study used South Africa as its context. To meet this objective, the following primary research question was formulated: **How can SMEs evaluate their existing ICTs before possibly adopting emerging DTs?** Literature showed that existing theories do not suffice for the evaluation of existing ICTs, as they focus strictly on the adoption of emerging DTs. Previous theories focused on the investigation of anticipated and expected values of emerging DTs, not the experiences or value acquired by using existing ICTs. Furthermore, literature showed that other ICT users or organisations only evaluated the financial aspect of existing ICT investment. Therefore, the study saw it fit to develop a model which integrates financial and non-financial factors in ascertaining both the financial and non-financial value of existing ICTs.

By answering Research Questions 1 to 5, the main research question was ultimately addressed. Figure 6.1 presents the final validated framework after SEM had been conducted, without the insignificant constructs and construct items. This framework thus provides a means for SMEs to evaluate their existing ICTs before possibly adopting emerging DTs. The framework shows that when SME owners wish to evaluate existing ICTs, they should consider social factors, and information obtained from the existing ICTs, as well as the performance of the hardware and software. SME owners also need to consider their overall experience with the existing ICTs. Another important factor to consider is psychological behaviour apropos of the existing ICTs. Ultimately, SME owners have the final say as to whether emerging DTs are to be adopted, or whether to continue use of existing ICTs.

7.4. Top Level Summary of Findings

This section will be structured as follows: SME owner perceptions, organisational factors, environmental factors, technical, and financial factors.

SME owner perceptions

The perceptions of SME owners regarding the adoption and use of ICTs have been found to be of significance, especially regarding the evaluation of existing ICTs. For SMEs, the ultimate decision-making responsibility regarding any ICT switch rests with the SME owner, who holds the highest decision-making position in the organisation. The concept of satisfaction fundamentally underscores the decision whether to adopt emerging DTs or to continue to use existing ICTs. Results obtained in this study suggest that perceptions held by South African SME owners regarding existing ICTs are the greatest predictors in the evaluation of said ICTs.

It is imperative to note that SME owners' perceptions are also, to some extent, influenced by their social surroundings. Findings show that people considered important by SME owners, influence their decisions regarding the evaluation of existing ICTs before they adopt emerging DTs. Apart from social influences, the study also indicated that the behaviour and overall satisfaction of an SME owner is determined by his or her experience of using the existing ICTs. If the performance of the existing ICT is satisfactory, and the effort it demands is within reason, the SME owner will generally be satisfied with the existing ICTs. Hence the owner would prefer continued usage of the existing ICTs. However, if the effort demanded by the existing ICTs is annoyingly great, together with reduced performance of the said ICTs, SME owners will more likely favour adoption of emerging DTs.

These results mean that South African SME owners consider their personal discernment, observation, perception, and feelings when making adoption decisions. Even though South African SME owners are guided by significant others, they ultimately use their personal judgement to decide whether to adopt emerging DTs or to continue using existing ICTs. Similarly, perceptions and experiences of SME owners with existing ICTs are dependent on how long they have been using these ICTs.

Organisational factors

The results obtained in this study show that South African SME owners do not view organisational factors as important when evaluating their existing ICTs. This outcome signifies that South African SME owners do not necessarily see the need to provide

ongoing training and assistance to their employees on the use of existing ICTs. This premise also holds true for possible consultation with employees on whether existing ICTs are still useful, or whether technological change is needed. The results suggest that South African SME owners have the ultimate say in the next step to be taken for the continued use of existing ICTs or the adoption of emerging DTs.

Environmental factors

The results obtained in this study show that SME owners and their organisations are not influenced by environmental forces exerted upon them by other organisations, emerging DTs, or the need to remain competitive. South African SME owners pointed out that their decision to either adopt emerging DTs, or to continue using existing ICTs, is not dependent on the environment in which their organisation operate. SME owners in South Africa understand that organisations possess different capabilities. As such, they do not see the need to compete by adopting emerging DTs. SME owners would rather gauge their capabilities before deciding whether to adopt emerging DTs or continue using existing ICTs.

Technical factors

The study investigated each ICT component independently. From literature, the study concluded that many entrepreneurs tend to replace the whole ICT because its performance has waned, when at times, replacing only a single faulty component is required. Driven by this hypothesis, the study investigated the role of each ICT component in evaluating the existing ICT. The research study deduced from literature that a complete ICT consists of the following components: software, hardware, network, database, cloud computing, data, and information. Even though literature dictates data as an ICT component, it was not investigated by this study. The SME owner focuses primarily on the output (information) from the ICT.

SME owners operating in South Africa identify hardware, software, and information as the most important components in the evaluation of existing ICTs. This means that when SME owners need to evaluate an existing ICT, they look at the performance of its hardware, software, and the usefulness, quality, and timeliness of the output. South African SMEs seem reluctant to use storage services such as cloud computing and

database. This suggests that these storage services may not be sufficiently important; SME owners are insecure in the use of cloud services; storage services are too expensive, or they do not generate large enough volumes of data (Big data) to warrant use of these sophisticated storage services. The literature reviewed identified cost as an impediment and a challenging factor for most SMEs, in both developing and developed countries; these results are therefore not surprising. However, future research could qualitatively investigate the reasons for network, database and cloud computing services not being deemed important; while hardware, software, and information are viewed as significant.

Financial factors

As much as the literature review proved that financial implications were a major factor worth considering when evaluating existing ICTs this study failed to affirm such a claim from literature. Financial evaluations models were not investigated in detail. The study was limited by its failure to forecast and adopt enough financial models to be used in SEM. Literature suggested that two financial models would suffice to evaluate any ICT investment, hence the study adopted two financial models (PBK and NPV). However, SEM requires the use of two or more observable variables. This study could not meet this requirement: one of the financial models (NPV) failed to uphold this requirement that there should be an equal representation of data for any observable variable. NPV was thus ultimately dropped from the analysis. The dropping of NPV as an observable variable led to the latent variable FEMs having a single observable variable, namely PBK. Ultimately, FEMs could not be computed in the SEM analysis, leading to an inconclusive result for financial implications. This was seen as a limitation, which will be revisited under the limitation section, and possibly addressed in future research.

Overall, the study did conclusively note that SME owners' psychological views, as well as the existing ICTs' performance, are more important factors when evaluating existing ICTs. SME owners' psychological views are driven by the social environment. SME owners should not base their decisions on continuing use of existing ICTs solely on their personal experiences. Such may result in the misconception that existing ICTs are better than emerging DTs, or vice versa. Some existing ICT features such as network, databases and cloud computing; and the SME surroundings are not

important. SME owners' satisfaction with existing ICTs, however, is important. This research study is projected to provide SME owners with a handy tool for evaluating existing ICTs.

7.5 Research Contributions

The contribution that this research makes is both explanatory and descriptive as it has both *what* and *how* research questions which descriptive and explanatory studies seeks to answer respectively.

Research questions 1 and 2 were *what* type of questions, and the study answered these descriptively. This was also the case for research question 3, which was a 'which' type of question. 'Which' and 'what' type of questions attempt to identify a phenomenon. Hence research question 3 was answered in a descriptive manner. Below are research questions 1, 2 and 3.

1. What are both the financial and non-financial factors relevant to the evaluation of SMEs' existing ICTs before decisions are made on either adopting or rejecting emerging DTs?
2. What are the technological, organisational, individual, and social factors needed in the evaluation of existing ICTs before deciding whether to adopt or reject emerging DTs?
3. Which are the successful financial models that have been used in evaluating ICT investments?

Research questions 4 and 5 were How? type of questions and the study answered them in an explanatory way. Below are research questions 4 and 5.

1. How can the determined financial and non-financial factors be integrated into a conceptual framework to inform the effective evaluation of existing ICTs?
2. How can the conceptual framework for evaluation of existing ICTs be validated?

Explanatory research seeks to answer the research question by identifying the causal factors and results of the target phenomenon (Bhattacherjee, 2012). This study sought to investigate how can SME owners evaluate their existing ICTs, hence causal relationships among various factors were theorised, tested and interpreted both theoretically and practically to draw meaning. The following section details the theoretical, and practical contribution the study makes.

7.5.1 Contributions to information systems

The concept of ICT evaluation is not new, it has only been called by different terms. Other stakeholders called it assessment, while others referenced the term appraisal. On the same note, various stakeholders used different tools to assess, appraise, or evaluate the entity under investigation. These tools have not always been sufficient. There is limited literature on the evaluation or assessment of existing ICTs within SMEs. In addition to dealing with ICTs, a large portion of the literature surveyed focused on emerging technology adoption, use, and acceptance. Effort was therefore made to contextualise the surveyed literature to evaluation of existing ICTs in the South African SME environment. Thus, the study contributes to the IS body of knowledge, by scoping a literature body specific to the evaluation of existing ICTs in South African SMEs. For this reason, IS researchers could use this literature as a reference and/or starting point when conducting ICT evaluation studies in SMEs in other countries or in non-SME environments. This study therefore contributes significantly to the IS body of knowledge.

The study contributed new knowledge through the development and validation of an empirical framework that can be used in SMEs and other environments to evaluate existing ICTs. The study finally augmented the limited literature on the evaluation of existing ICTs.

7.5.2 Contribution to practices

This study was carried out in the context of South African SMEs. It is therefore expected that South African SMEs will use the developed and validated framework to

evaluate their existing ICTs before they attempt to adopt emerging DTs. The same framework might also help SMEs in other countries in evaluating their existing ICTs or at least as a starting point. This framework may also be used by other organisations (non-SMEs) as a basis for contextualising the evaluation of existing ICTs in their organisations. Effective use of this framework could aid in decision making processes with regards to the evaluation of existing ICTs. Since this framework helps SMEs in evaluating their existing ICTs, it will in turn, ensure the use of the appropriate ICTs at the right time. Such will be achieved by enabling SMEs to evaluate whether existing ICTs are useful, or whether owners should adopt emerging DTs.

It is imperative to note that, in this 4IR era, technologies are being developed at an alarmingly fast rate, such that SMEs need to stay abreast to cope with the pace of change. As such, SMEs require to be equipped such that that they can continue to use the best ICTs. This study makes a positive contribution in stating that adoption of emerging DTs is not the only way that SMEs can keep engaging the best ICTs. Instead, owners should evaluate their existing ICTs to see whether they are still useful. Evaluation can lead to SMEs' continued use of the pertinent ICTs. Upon assessing the existing ICTs, if the said ICTs are no longer of value, the SMEs might need to consider adoption of emerging DTs. Furthermore, as much as 4IR technologies such as AI, machine learning, nanotechnology, biotechnology, quantum computing, block chain, IoT, 3D printing, and others come with powerful capabilities that SMEs can take advantage of, some of these technologies and their capabilities might overwhelm the owners. Such technologies might also not be useful for SMEs, the evaluation of existing ICTs becoming handy. Therefore, the framework that this study developed is likely to assist SME owners in evaluating their existing ICTs.

7.6 Limitations of the Study

During the course of this study, efforts were made to avoid all shortcomings which might result in inaccuracies and/or falsifications of results. Typically, however, as in most research studies, some constraints were beyond the researcher's control. These constraints might have impacted negatively on the research process, and could thus have resulted in limitations to the findings. At its inception, this study set out to be as

inclusive of all SME owners as possible. However, owing to unforeseen circumstances, including time constraints and the unwillingness of some SME owners to participate in the study, the researcher finally sampled only 267 SMEs operating in South Africa. Ultimately, 222 responses were deemed usable. Therefore, the conclusions drawn in this study were based on the views of 222 SME owners. Care should be taken to generalise these results for SMEs in other countries (low and high income) and continents. The framework developed by this study can, however, be used as the basis for contextualising a study in other environments such as non-SMEs or SMEs in other high and low-income countries.

Time also proved to be a limitation to this study. After waiting for a whole year to collect the much-needed data, the study could only collect 222 usable questionnaires. Therefore, for studies of this nature, the longitudinal approach, which allows more time for the collection of data is more suited than a cross-sectional approach.

A qualitative, or mixed-method approach, could be adopted in an effort to understand why some ICT components are more important than others when evaluating existing ICTs. Such explanatory studies will address the ‘Why?’ governing the rejection or acceptance of ICT components.

The literature suggested that the use of two financial models would suffice for the evaluation of an ICT investment. However, for this study, the adoption of two models later manifested as a stumbling block. The study could not include the financial models in SEM analysis because one of the financial models (NPV) did not meet the assumptions of SEM. The study therefore did not include PBK, as it could not be used on its own (violation of SEM assumption). This research study needed three or four financial models, so that if one or two failed to meet the assumptions of SEM, there would still be two other models to fall back on. The next section will detail the recommendations the study will make in order to avoid the said limitations this study faced.

7.7 Recommendations and Future Work

Based on the remarks and elaborations concerning the challenges and limitations posed by this study, future work in the field of evaluation of existing ICTs is recommended.

This study needs to be repeated under longitudinal circumstances, affording the researcher ample time to collect sufficient data to include as many SME owners as possible, so as to be confident in generalising the results across South Africa. Furthermore, other researchers can repeat this study using SMEs in other countries, within both the developed and developing context, to further validate the developed research framework. The need also exists to replicate similar research with data collected from both SME owners and employees. It is important to explore the beliefs and attitudes of the employees. One can then ascertain whether SME owners influence employees on which technology to use, existing or emerging DTs.

Not all SMEs use the same ICTs. Different SMEs use different ICTs; and SME owners' perceptions of these differing ICTs are certainly bound to vary. Therefore, for better and informative results, it would be appropriate to analyse data collected from SMEs which use the same ICTs so that the perceptions collected relate to the same ICTs. One ICT may be more complex than another, hence users' perceptions regarding these different ICTs could very well differ. Future research should thus focus on collecting data from SMEs which use the same ICTs. Furthermore, future research might consider collecting data from employees working in a single, larger organisation.

This research study could not analyse the hypotheses linked to financial evaluation models, owing to the failure to meet the technical assumptions of the statistical methods used in the study. Therefore, future research should also consider using a qualitative approach, thus facilitating a holistic understanding of how finances are approached by SMEs in South Africa. A qualitative investigation will also facilitate in understanding of how SMEs consider the financial evaluation of existing ICTs.

In line with limitations posed by the application of financial models encountered in this study, future researchers, following the quantitative approach, should consider using four or more financial models during the preliminary stages of the study, instead of only two, as suggested by literature. The purpose is to ensure that if one or two financial models fail to meet the statistical assumption/s, two or more financial models could still be used to draw conclusive results, as far as financial models are concerned. Literature suggested that the most prominent, frequently, and successfully used financial models are NPV and PBK. Therefore, future studies should consider complementing NPV and PBK with two or more other financial models.

This study was conducted quantitatively. SME owners were thus not afforded the opportunity of explaining why they only evaluate hardware, software, and information of existing ICTs; and why they do not view database, network, and cloud computing services as important. Future research should consider a qualitative or a mixed method approach to gain SME owners' thoughts about their existing ICTs and emerging DTs.

Methodologically, a comparative enquiry in which the perceptions of employees and SME owners are compared, could be of value to studies of this nature. Certain SME owners might believe that existing ICTs are still useful, whilst employees believe the opposite. In such cases, employees will use the existing ICTs under mandatory conditions. Therefore, future research should consider investigating the perceptions of employees and SME owners in a comparative study. Comparative studies could also be used to evaluate both emerging and existing ICTs, so that SME owners can be equipped in terms of which technology is better and favourable.

In conclusion, as much as the established ICT evaluation framework in this research study is comprehensive, it cannot be declared exhaustive. Future research may add or extend this framework by including other precursors to evaluation which might have been overlooked by this study. The framework developed by this research study will become the foundation and starting point for those studies.

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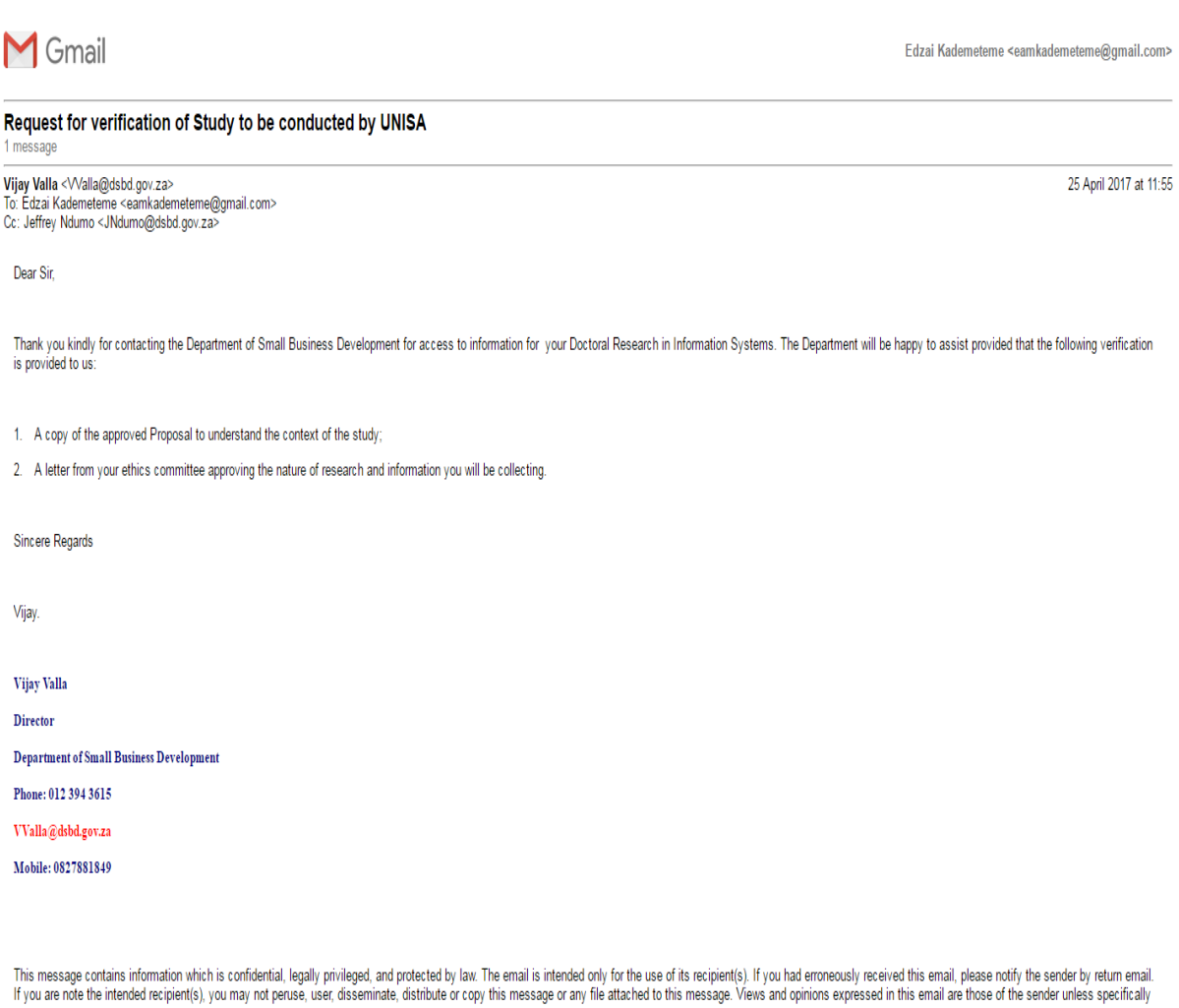
APPENDICES

APPENDIX A: Approval Letter



Gmail

Edzai Kademeteme <eamkademeteme@gmail.com>

Request for verification of Study to be conducted by UNISA

1 message

Vijay Valla <VValla@dsbd.gov.za> 25 April 2017 at 11:55
To: Edzai Kademeteme <eamkademeteme@gmail.com>
Cc: Jeffrey Ndumo <JNdumo@dsbd.gov.za>

Dear Sir,

Thank you kindly for contacting the Department of Small Business Development for access to information for your Doctoral Research in Information Systems. The Department will be happy to assist provided that the following verification is provided to us:

1. A copy of the approved Proposal to understand the context of the study;
2. A letter from your ethics committee approving the nature of research and information you will be collecting.

Sincere Regards

Vijay.

Vijay Valla

Director

Department of Small Business Development

Phone: 012 394 3615

VValla@dsbd.gov.za

Mobile: 0827881849

This message contains information which is confidential, legally privileged, and protected by law. The email is intended only for the use of its recipient(s). If you had erroneously received this email, please notify the sender by return email. If you are note the intended recipient(s), you may not peruse, user, disseminate, distribute or copy this message or any file attached to this message. Views and opinions expressed in this email are those of the sender unless specifically

APPENDIX B: University Ethics Approval Letter

UNISA university of south africa

UNISA COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY'S (CSET) RESEARCH AND ETHICS COMMITTEE

29 May 2017

Ref #: 021/EKA/2017/CSET_SOC
Name: Edzai Kademeteme
Student #: 48207179

RECEIVED
2017 -06- 05
OFFICE OF THE EXECUTIVE DEAN
College of Science, Engineering and Technology

Dear Edzai Kademeteme

Decision: Ethics Approval for a period of three years (Humans involved)

Researcher: Edzai Kademeteme
Unit No. 15, Alzea Court, 251 Glover Street, Centurion, Pretoria, 0157
eamkademeteme@gmail.com, +27 73 959 7979

Supervisor (s): Prof. H. Twinonurizi
+twinoh@unisa.ac.za, +27 11 670 9361

Proposal: Technology evaluation model: Post benefits, post acceptance, post adoption, post usage analysis

Qualification: PhD

Thank you for the application for research ethics clearance by the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee for the above mentioned research. Ethics approval is granted for a period of three years from 29 May 2017 to 29 May 2020.

Thank you for the application for research ethics clearance by the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee for the above mentioned research. Ethics approval is granted for a period of three years from 29 May 2017 to 29 May 2020.

1. The researcher will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the Unisa College of Science, Engineering and

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

Technology's (CSET) Research and Ethics Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.

3. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.
4. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
5. Permission to conduct this research should be obtained from the Department of Small Business Development (DSBD) and participating SMEs prior to commencing field work.

5. Permission to conduct this research should be obtained from the Department of Small Business Development (DSBD) and participating SMEs prior to commencing field work.

Note:
The reference number 021/EKA/2017/CSET_SOC should be clearly indicated on all forms of communication with the intended research participants, as well as with the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee

Yours sincerely

Adè da Veiga

Dr. A Da Veiga

Chair: Ethics Sub-Committee School of Computing, CSET

Pp: Ukwoaze

Prof I. Osunmakinde

Director: School of Computing, CSET

(PROF FW ADDE KTON)

for Prof B. Mamba

Executive Dean: College of Science, Engineering and Technology (CSET)

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
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APPENDIX C: Anonymous Survey Questionnaire and Consent Form

Online Survey Questionnaire that includes link to Anonymous Survey Template

Research Questionnaire Survey

The objective of this study is to develop a conceptual framework that could be used in the evaluation of existing ICT before attempting to adopt an emerging ICT within SMEs in South Africa. In order to achieve that goal, the study will use this Form to collect SME Owners' perceptions about the Computer Technologies they are currently using as well as the one that is likely to replace the one they are currently using. Technology or ICT in this study refers to any mobile technology or computer that facilitates the production, gathering, distribution, consumption and storage of information (Torero and von Braun, 2006). This Form has a better VIEW in Google Chrome or Internet Explorer version 11 and above, any other Web Browser will not have a good VIEW

*Required

Anonymous Survey Template

COVER LETTER TO AN ONLINE ANONYMOUS WEB-BASED SURVEY

Dear Prospective participant,

You are invited to participate in a survey conducted by Kademeteme Edzai under the supervision of Hossana Twinomurinzi, a Professor, in the Department of Computing towards a PhD in Information System at the University of South Africa.

The survey you have received has been designed to study the topic, "A 4IR FRAMEWORK FOR ICT EVALUATION: A CASE FROM SOUTH AFRICAN SMEs". You were selected to participate in this survey because you are an SME owner. If you are under the age of 19 you are not allowed to participate in this study. By completing this survey, you agree that the information you provide may be used for research

purposes, including dissemination through peer-reviewed publications and conference proceedings.

It is anticipated that the study will come up with means and ways to evaluate existing computers. You are, however, under no obligation forced to complete the survey and you can withdraw from the study prior to submitting the survey. The survey is developed to be anonymous, meaning that we will have no way of connecting the information that you provide to you personally. Consequently, you will not be able to withdraw from the study once you have clicked the send button based on the anonymous nature of the survey, however any identifying information that is obtained in connection with this survey will remain confidential and will be disclosed only with your permission or as required by law. If you choose to participate in this survey it will take up no more than 15 minutes of your time. You will not benefit from your participation as an individual, however, it is envisioned that the findings of this study will assist SMEs owners in South Africa in to making informed decisions as far as evaluation of existing computers is concerned, whether to continue with their use or adopt emerging computers. We do not foresee that you will experience any negative consequences by completing the survey. The researcher(s) undertake to keep any information provided herein confidential, not to let it out of our possession and to report on the findings from the perspective of the participating group and not from the perspective of an individual.

The records will be kept for five years in a google drive which is accessible by the researcher only in case of audit purposes where after it will be permanently destroyed by means of permanently deleting from the google drive. You will not be reimbursed or receive any incentives for your participation in the survey.

The research was reviewed and approved by the UNISA School of Computing Ethics Review Committee. The primary researcher, Edzai Kademeteme, can be contacted during office hours at +27 61 365 1257. The study leader, Prof Hossana Twinomurinzi, can be contacted during office hours at +27 11 670 9361.

Should you have any questions regarding the ethical aspects of the study, you can contact the chairperson of the UNISA School of Computing Ethics Review Committee, +27 11 670 9175. Alternatively, you can report any serious unethical behaviour at the University's Toll Free Hotline 0800 86 96 93.

You are making a decision whether or not to participate by continuing to the next page. You are free to withdraw from the study at any time prior to clicking the button to give consent.

Section 1

Before you complete the Survey, you are kindly asked to read and agree to the Anonymous Survey and Consent Form below. The consent form guarantees you that participation in this study is anonymous. The consent form requires you to voluntarily agree or disagree to participating in this study. Only participants who have agreed to the consent corm will be allowed to complete the survey. To read the consent form please follow the link below, and then click accept to continue with the survey

Research Information and Consent Form

Research Topic: A 4IR FRAMEWORK FOR ICT EVALUATION: A CASE FROM SOUTH AFRICAN SMEs

Introduction

This form serves to get consent for your participation in the research project to develop a 4IR framework for ICT evaluation: a case from South African SMEs. The purpose of the framework to be developed by this study intends to assist SME owners with a tool that can assist them in the evaluation of the current existing ICTs before they can adopt any new technology in the market. ICTs are evolving quickly, and SME owners have to make a decision as to either continue using the existing ICTs (computers) that the organisation already owns, or to adopt the emerging digital technologies (computers). After conducting a literature review, the study found out some of the factors that are necessary when evaluating existing ICTs. Therefore, this study requires your consent to be involved in answering questions about the factors involved in the evaluation of existing ICTs.

Purpose of research this study is aimed at collecting data about your thoughts regarding the existing ICTs in use at your organisation whether they are still meeting your expectations or not.

Procedure

The entire questionnaire will require approximately 15 minutes of your time. The study requires you to complete a questionnaire about your thoughts and views concerning existing ICTs in your organisation.

Confidentiality.

The input you provide will be treated confidentially and only be used towards the completion of the afore-mentioned research. All data will be used in summary form without reference or link to any individual. Your name should not be recorded anywhere on the questionnaire you will be provided.

Participation

Participation in this research study is voluntary, and you have the right to withdraw or refuse to participate at any time and no one will question your decision. The consent form has been incorporated and ensured in the questionnaire and if the respondent does not agree to the consent, the questionnaire will automatically end the online survey.

Benefits and compensation

Participating in this study does not present any direct benefits to the participant or organisation, but rather your participation might improve and have benefits on SMEs in South Africa, by presenting a framework that can assist SME owners with a tool to evaluate existing computers before adopting emerging computers. Therefore, there are no benefits or compensations for participating in this study.

Risks and discomforts

There are no risks or discomfort associated with your participation. All answers from you and other participants will be analysed collectively. Individual answers will therefore not be linked to any names, positions and companies of participants.

Participant consent

I have read and understood all the above. I willingly choose to participate in this study. If you willingly choose to participate in this study, please click agree Accept to continue with the Survey, else Click Reject. If you click Reject the form will take you to the last page of the questionnaire where the exit button is.

1. I have read and understood the consent form. I willingly choose to participate in this study. * Mark only one oval.

   Accept ◯ *Skip to question 2.*
   Reject ◯ *Stop filling out this form.*

Section 2

Part One: Participants Demographics and Experience

2. What is the year you were born? *

   _____

3. What is your gender?***** *Mark only one oval.*

   Male ◯
   Female ◯

4. What is your highest level of education? ***** *Mark only one oval.*

   Matric / Certificates ◯
   Diploma ◯
   Degree ◯
   Postgraduate ◯
   Other: _____

5. Specify the year you started your organisation *

   _____

6. On average how do you rate your knowledge of using existing mobile or computers? * *Mark only one oval per row.*

	No knowledge	Weak	Average	Good	Excellent
Mobile					
Computers					

7. Do you have any existing Technology in your organisation? * *Mark only one oval.*

   Yes *Skip to question 8.*

   No *Skip to question 15.*

Existing Technology Financial Evaluation

1. Which Technology are you currently using in your organisation? * *Mark only one oval.*

   Mobile

   Computers

2. Which year did you start using the existing Technology in your organisation? *

3. When was the Technology you use in your organisation purchased? *

4. Approximately what was the cost of acquiring the Technology you are currently using in your organisation? *

5. Approximately how much money per year do you make through use of the current technology in your organisation**?** *

6. Approximately how much money per year do you budget for maintaining the technology you are currently using in your organisation? *

7. For how many years would you continue to use the current technology before you purchase another one? *

Emerging Technology Availability

1. Is there a technology that is likely to replace the one you are currently using in your organisation? * *Mark only one oval.*

Yes ◯ *Skip to question 16.*

No ◯ *Skip to question 20.*

Emerging Technology Financial Evaluation

1. Approximately what is the cost of acquiring the new technology? *

_____

2. Approximately how much money per year do you think you can make through use of a new technology? *

_____

3. Approximately how much will it cost for maintenance, amongst other costs, of the new technology? *

_____

4. Approximately when do you think you will purchase the new technology? *

_____

PART TWO: PERCEPTIONS ABOUT EXISTING TECHNOLOGY EVALAUTION AGAINST EMERGING TECHNOLOGY

Using a rating scale of 1 to 5, where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree and 5 = strongly agree. Indicate your level of disagreement /agreement with the following statements

Technological Factors

5. A. Hardware * *Mark only one oval per row.*	
Hardware components that make up the technology in my organisation have high response time than those of the emerging technology	SD D N A SA

Hardware components that make up the technology in my organisation are highly reliable than those for the emerging technology	SD D N A SA
Hardware components that make up the technology in my organisation are easy to use than for the emerging technology	SD D N A SA
Hardware components in my organisation are available for use anytime I need them than they will be for the emerging technology	SD D N A SA

6. B. Software * *Mark only one oval per row.*	
The Software components that make up the technology in my organisation have high response time than those for the emerging technology	SD D N A SA
The Software components that make up the technology in my organisation are highly reliable than those for the emerging technology	SD D N A SA
The Software components that make up the technology in my organisation are user friendly than for the emerging technology	SD D N A SA
It is easy for me to use software components in my organisation than it is for the emerging technology	SD D N A SA

7. C. Information* *Mark only one oval per row.*	
The information I get from the technology in my organisation is accurate more than i will get from the emerging technology	SD D N A SA
The information I get from the technology my organisation is timeliness than the information will get from the emerging technology	SD D N A SA

The information I get from the technology in my organisation is complete than the information i will get from the emerging technology	SD D N A SA
The information I get from the technology in my organisation is relevant than the information i will get from the emerging technology	SD D N A SA
The information from the technology in my organisation is accessible any time of the day than it will be with the emerging technology	SD D N A SA

8. D. Network* *Mark only one oval per row.*	
The network in my organisation is more reliable than it will be with the emerging network	SD D N A SA
The network in my organisation has high response time than the emerging network	SD D N A SA
The network in my organisation is highly secured than the emerging network	SD D N A SA
I can access the network in my organisation anytime of the day than emerging network	SD D N A SA

9. E. Database* *Mark only one oval per row.*	
The databases in my organisation are reliable more than emerging databases	SD D N A SA
I can access database(s) in my organisation anytime than i will with emerging databases	SD D N A SA
Databases in my organisation are more secured than emerging databases	SD D N A SA
Databases in my organisation have lots of free space to save any kind of documents than emerging databases	SD D N A SA

10. F. Cloud Computing (Online Storage) * *Mark only one oval per row.*	
Cloud computing services are reliable with existing technology than they will be with emerging technology	SD D N A SA
I can access information on the cloud quicker with the existing technology than it will be with the emerging technology	SD D N A SA
Cloud computing services are highly secured with the existing technology than they will be with the emerging technology	SD D N A SA
I can access information in the cloud anytime and anywhere with the existing technology than i will with the emerging technology	SD D N A SA
Cloud Computing technology is compatible with the current technology infrastructure (hardware / software) in my organisation than it will be with the emerging technology	SD D N A SA
I found it easy to use cloud computing services with the existing technology than i will with the emerging technology	SD D N A SA

User Perceptions

11. A. Effort Experience * *Mark only one oval per row.*	
My employees interaction with the technology in my organisation are clear and understandable than it will be with the emerging technology	SD D N A SA
It was easy for my employees to become skillful at using the technology in my organisation than it will be with the emerging technology	SD D N A SA

My employees find existing technology easy to use than emerging technology	SD D N A SA
Learning to operate the technology in my organisation was easy for my employees than it will be with the emerging technology	SD D N A SA

12. B. Performance Experience* *Mark only one oval per row.*	
My employees found technology in my organisation useful for their job and daily activities than emerging technology will	SD D N A SA
Using the technology in my organisation enabled my employees to accomplish tasks more quickly than the emerging technology	SD D N A SA
Using the technology in my organisation increased my employees productivity more than emerging technology will	SD D N A SA
It would be easy for my employees to become skillful at using the technology in my organisation than it will be with the emerging technology	SD D N A SA
If my employees keep using the technology in my organisation, they will increase their chances of getting a raise than they will with the emerging technology	SD D N A SA

13. C. Social Factors* *Mark only one oval per row.*	
People who influence my behaviour think that my employees should keep using the technology in my organisation than to adopt emerging technology	SD D N A SA
People who are important to me think that my employees should keep using the technology in	SD D N A SA

my organisation than to adopt the emerging technology	
The Senior management of this organisation are very helpful to their subordinates in the use of the technology in my organisation than they will be with the emerging technology	SD D N A SA
In general, the organisation has been so supporting when it comes to the use of technology in my organisation than they will be with emerging technology	SD D N A SA

14. D. Environmental Factors * *Mark only one oval per row.*	
I believe using the technology in my organisation will be important to keep up with competition in market than it will be with the emerging technology	SD D N A SA
I believe my organisation is not influenced by its competitors to adopt the emerging technology compared to continual usage of the existing technology	SD D N A SA
The rate at which technology become outdated in our business environment is low that the existing technology in my organisation is favoured more than adopting the emerging technology	SD D N A SA

15. E. Organisational Factors* *Mark only one oval per row.*	
The top management in my organisation is supportive in the use of the existing technology than to adopt the emerging technology	SD D N A SA

The use of the existing technology meets management expectations more than the emerging technology	SD D N A SA
A specific person or group is available for assistance with difficulties in the use of the existing technology than it will be with the emerging technology	SD D N A SA
Employees in my organisation receive regular training for usage of the existing technology than they will with the emerging technology	SD D N A SA
I consult my employees for changes in any technological change in my organisation	SD D N A SA
My organisation does not have enough financial capability to adopt the emerging technology hence favoring continual usage of the existing technology	SD D N A SA

16. F. Behavioural Intention to use* *Mark only one oval per row.*	
I intend my employees to continue using the technology in my organisation for the next 5 years than to adopt the emerging technology	SD D N A SA
I predict my employees to continue using the technology in my organisation for the next 5 years than to adopt the emerging ICT	SD D N A SA
I plan for my employees to continue using the technology in my organisation for the next 5 years than to adopt the emerging technology	SD D N A SA

17. G. User Satisfaction* *Mark only one oval per row.*	
I am satisfied that the technology in my organisation still meets my employees knowledge	SD D N A SA

or information processing needs than the emerging technology will	
I am satisfied with the efficiency of the technology in my organisations than i will be with the emerging technology	SD D N A SA
I am satisfied with the effectiveness of the technology in my organisation than i will be with the emerging technology	SD D N A SA
Overall, I am satisfied with the technology in my organisation than i will be with the emerging technology	SD D N A SA

Dynamic Capabilities

18. A. Absorptive capability* *Mark only one oval per row.*	
We frequently scan the environment for new technologies	SD D N A SA
We frequently acquire technologies from external sources	SD D N A SA
We quickly analyze and interpret changing market demands for our technologies	SD D N A SA
We regularly match new technologies with ideas for new products	SD D N A SA

19. B. Adaptive capability* *Mark only one oval per row.*	
My organisation responds quickly to changes in customers need and changes in business environments	SD D N A SA
My organisation adapts quickly to shifts in our business goals / strategies	SD D N A SA

My organisation keeps a check of changes in the market	SD D N A SA
Our existing competency can withstand changes in the industry	SD D N A SA
My organisation encourages me to adopt new marketing techniques	SD D N A SA
My organisation constantly observes competitors actions	SD D N A SA

20. C. Innovative capability* *Mark only one oval per row.*	
My organisation uses external information to transform business processes	SD D N A SA
My organisation Introduces new products / services which are at the cutting edge of technology	SD D N A SA
Our technology reinforces how our company currently compete	SD D N A SA

21. OVERALL Evaluation of Existing against Emerging ICT * *Mark only one oval per row.*	
My employees performance on the job is enhanced by using the existing technology than it will be by using the emerging technology	SD D N A SA
The existing technology help the organisation save cost as compared to the emerging technology	SD D N A SA
The existing technology enables my employees to accomplish tasks more efficiently more than the emerging technology will	SD D N A SA

The existing technology in my organisation helps the organisation achieve its goals more than what the emerging technology will	SD D N A SA
The existing technology increases our productivity more than what the emerging technology will	SD D N A SA
Overall, my employees would continue with using the existing technology than adopting the emerging technology	SD D N A SA