DEVELOPING A FRAMEWORK FOR ADOPTION OF CLOUD COMPUTING BY SMALL MEDIUM ENTERPRISES IN ZIMBABWE

by

RICHARD TAWANDA SHONIWA

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Supervisor: Prof. M.E. Herselman

Co-supervisor: Prof. A. Botha

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ABSTRACT

Small, micro and medium enterprises (SMEs) are seen as the panacea for economic growth and unemployment in Zimbabwe. Thriving SME sectors represent a thriving national economy. Conversely, the failed SMEs sector in Zimbabwe represents a failed national economy. Literature shows that 85% of SMEs in Zimbabwe fail, 60% of these close within the first year and about 25% during the first three years of operation. This high failure rate is attributed to intense global market competition from other developed countries and lack of adequate business information to penetrate other markets due to underdeveloped technological and communication infrastructures. The evidence from the literature suggests that cloud computing offers a new and better way of conducting businesses in SMEs.

Adopting cloud computing increases SMEs' competitive edge; allows SMEs to access sophisticated IT resources without capital expenditure, which gives them time to focus on their core competencies. Despite these benefits of cloud computing, SMEs in Zimbabwe are still struggling to adopt cloud computing both as a technological and business strategy. Decisions to adopt cloud computing are complicated because many variables are involved in the adoption equation. Making informed decisions to migrate to the cloud requires support tools (frameworks) to help decision-makers to evaluate and analyse their legacy systems in a more systematic way and decide whether to migrate to the cloud or not.

Despite the availability of many cloud adoption frameworks, the ever-changing technological landscape makes it even more challenging for SMEs in Zimbabwe to adopt a cloud computing framework developed in a different setting. Thus, the unavailability of cloud computing adoption frameworks developed in Zimbabwe makes it more difficult for SMEs to migrate their legacy systems to the cloud. For this reason, this study aims to fill this research gap by developing a cloud computing adoption framework to assist SMEs in Zimbabwe to migrate to the cloud.

The Design Science Research Methodology (DSRM) was applied to answer the research questions and iteratively develop the ZiCAM artefact. The main philosophy which guided the research is pragmatism. Interpretivism was applied in Phase 1 during the literature review and Phase 2 during the study's interview phase. Positivism was used during Phase 3, in which a questionnaire distributed to a sample size of 345 participants.

Phase 1 of the study developed an initial cloud adoption framework based on two frameworks, the DOI and TOE, which provided the theoretical framework for this study. The interviews in Phase 2 validated the initial framework, which culminated in developing the intermediate framework. The findings in Phase 2 helped develop a web-based questionnaire administered in Phase 3 to sampled SMEs in Harare and Bulawayo (Zimbabwe). The findings from Phase 3 were used to develop the final conceptual cloud computing adoption model (ZiCAM) by SMEs in the two cities in Zimbabwe. Multilinear regression analysis was used to evaluate the ZiCAM artefact.

Seven factors were identified as important for influencing the likelihood that SMEs would adopt Cloud computing successfully. The factors are trialability, compatibility (technological factors), size of an organisation, IT knowledge of employees and technological readiness (organisational factors) and lastly, competitive pressure and accessibility to up to date information (environmental factors).

Besides contributing to praxis and adding new knowledge to the IS body of knowledge, the findings of this study are also important to owners and decision-makers of SMEs, cloud service providers and the Zimbabwean government. The ZiCAM model will enable them to facilitate the adoption of cloud computing by SMEs by establishing strategies and a conducive environment to stimulate faster adoption of cloud computing by SMEs.

Keywords

Design Science Research, Artefact, Cloud Computing, IT adoption framework, Small and Medium Enterprises (SMEs), Diffusion of Innovation, Technological, Environmental and Organisation framework, Multilinear regression, Developing countries, Digital divide, Role of SMEs and Zimbabwe.

DEDICATION

To God, be the glory. I dedicate this thesis to my late parents, Michael Razaro and Perpetual Shoniwa, my wife Lin, my children Michael and Tawananyasha.

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To God, be the glory. Firstly, I would like to present my thankfulness to my Saviour Jesus Christ, for giving me the courage and strength to persevere with the study to finish my PhD amid the COVID-19 pandemic.

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Finally, I also thank all those nameless individuals who, directly or indirectly, have lent their hand in the completion of this thesis.

DECLARATION

I declare that, **DEVELOPING A FRAMEWORK FOR ADOPTION OF CLOUD COMPUTING BY SMALL MEDIUM ENTERPRISES IN ZIMBABWE**, is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I have not previously submitted this work, or part of it, for examination at UNISA for another qualification or at any other higher education institution.

SIGNATURE ______________ DATE:___15/10/2021________

(T.R. Shoniwa)
Student number: 49129872

ACRONYMS

AfDB	African Developing Bank
BAZ	Broadcasting Authority of Zimbabwe
DOI	Diffusion of Innovation
DSR	Design Science Research
DSRM	Design Science Research Methodology
DSS	Decision Support Systems
EFA	Exploratory Factor Analysis
FA	Factor Analysis
GDP	Gross Domestic Product
IaaS	Infrastructure as a Service
ICT	Information Communication Technologies
ICT4AD	Information Communication Technologies for Accelerated Development
IS	Information Systems
IT	Information Technology
MCA	Manual Content Analysis
MLR	Multilinear Regression
NIIT	National Institute of Standards and Technology
OECD	Organization for Economic Cooperation and Development
PaaS	Platform as a Service
POTRAZ	Postal and Communications Authority
SaaS	Software as a Service
SLA	Service Level Agreements
SMEA-ZW	Small and Medium Enterprises Association of Zimbabwe
SMEs	Small and Medium Enterprises
SPSS	Statistical Package for Social Scientists
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TOE	Technology Organisation Environment
UNCTAD	United Nations Conference on Trade and Development
UTAUT	Unified Theory of Acceptance and Use of Technology
ZIMRA	Zimbabwe Revenue Authority
Zimtrade	Zimbabwe Trade
VIF	Variance Inflation Factor

CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

Cloud computing technology has been generally hailed as a game-changer in terms of how businesses are run. Cloud computing has ushered in a new era of business; it has simplified access to worldwide marketplaces (Amini & Bakri, 2015; Erind, 2015; Palos-Sanchez, 2017) from any part of the earth. Unfortunately, due to technology's proliferation, markets have become sophisticated and very volatile (Chatzithanasis & Michalakelis, 2018). Organisations can no longer rely on obsolete traditional IT legacy systems, which cannot effectively compete in the volatile global market (Erind, 2015). The small businesses in the developing world that are financially handicapped and still using underdeveloped IT systems have been worst affected (Adane, 2018). It is estimated that five out of ten SMEs fail during the first five years of existence (Chimucheka & Mandipaka, 2015; Muriithi, 2017). Research attributes this massive failure rate to limited resources, lack of adequate business information due to underdeveloped technological and communication infrastructures and intense market competition from other developed countries (Karadağ, 2016).

Cloud computing can be a solution to challenges faced by SMEs. Cloud computing brings SMEs increased competitiveness and cost savings (Adane, 2018; Harfoushi, Akhorshaideh, Aqqad, Al Janini, & Obiedat, 2016; Widyastuti & Irwansyah, 2018). Organisations that adopt cloud computing will access computing resources like hardware, storage, applications and other computing services over the Internet (Wilson, Khazaei, & Hirsch, 2015). These services can be provisioned at the request of the customer. Thus, the customer can only pay for what they use. There will be no need to have expensive data centres on their premises. However, adopting new technology by any organisation can be a daunting task, especially with SMEs that are both financially and technologically disadvantaged (Adane, 2018; Widyastuti & Irwansyah, 2018). The ever-changing IT landscape and the diversity of IT applications on the market (Alkhalil, Sahandi, & John, 2017) exacerbate the daunting task of making informed decisions about whether to adopt the new technology or not. If a decision is made to adopt, organisations will still face challenges of where to start and what areas to focus on.

This research aims to develop a cloud adoption framework to help SMEs in Harare and Bulawayo in Zimbabwe migrate to the cloud. The framework will solve the challenges mentioned above faced by SMEs. There are many cloud computing adoption frameworks that SMEs could use. However, Zimbabwe, a unique, developing country, requires a home-grown cloud adoption framework tailor-made to suit its unique economic circumstances. The framework will identify and highlight important factors that must precede before an SME attempts to use cloud computing.

The Design Science Research method was applied to answer the research questions and develop the artefact (cloud adoption framework). Questionnaires and interviews were used to gather data from SME owners, promoters and managers in the purposefully sampled SMEs. The study was limited to SMEs in Harare and Bulawayo with between one and fifty employees and must be registered with the Small and Medium Enterprises Association of Zimbabwe (SMEA-ZW).

This introductory chapter presents an overview of the research. It starts with the introduction (discussed in Section 1.1), and describes the research background (discussed in Section 1.2), rationale and purpose of study (discussed in Section 1.3), research questions and objectives (discussed in Section 1.4), research methodology adopted for this study (discussed in Section 1.5), ethical considerations (discussed in Section 1.6), relevance and contribution of the study (discussed in Section 1.7), the scope of study and its limitations (discussed in Section 1.8),. The chapter ends with a conclusion (discussed in Section 1.9) and an outline of the thesis's structure (discussed in Section 1.0). The chapter serves as an introduction to the entire study.

1.2 BACKGROUND

Cloud computing has been hyped as the new business paradigm that can help SMEs to be efficient and competitive in the global market (Senarathna, Wilkin, Warren, Yeoh, & Salzman, 2018). Research shows that cloud computing adoption helps SMEs improve their business operations (Amini & Bakri, 2015). Different studies have highlighted numerous benefits to SMEs adopting cloud computing (Alkhalil et al., 2017; Amini & Bakri, 2015; Erind, 2015; Nguyen, Newby, & Macaulay, 2015; Senarathna et al., 2018). Adopting cloud computing increases SMEs' competitive edge; allows SMEs to access sophisticated IT resources without capital expenditure, which gives them time to focus on their core competencies (Chang & Barun Dasgupta, 2015; Chatzithanasis & Michalakelis, 2018).

Despite the acclaimed benefits of cloud computing, numerous efforts and initiatives to invest in the new technology and despite high global technological diffusion rate, SMEs in developing countries like Zimbabwe are still struggling to successfully adopt cloud computing both as a technology and business strategy (Alkhalil et al., 2017; Amini & Bakri, 2015; Erind, 2015; Nguyen et al., 2015). Research shows that SMEs in many developing countries grapple with a plethora of challenges; lack of capital; poor IT infrastructure; unfriendly government policies; lack of knowledge and uncommitted business owners, among other challenges (Agwu & Murray, 2015; Majoni, Matunhu, & Chaderopa, 2016; Sendawula, Turyakira, & Bananuka, 2018).

The road to cloud computing adoption is fraught with challenges and risks. Decisions to adopt cloud computing are complicated because many variables are involved in the adoption equation (Agwu & Murray, 2015). Making informed decisions to migrate to the cloud requires support tools (frameworks) to help decision-makers to evaluate and analyse their legacy systems in a more systematic way and decide whether to migrate to the cloud or not.

The rate of cloud computing adoption is still meager in SMEs, especially those in developing countries. It is imperative to understand SMEs' contextual settings to effectively develop a cloud computing framework that is user friendly and reflects the contextual factors in which SMEs operate. (Erind, 2015; Ez & Igbekele, 2019; Nguyen et al., 2015). There is *no one-size-fits-all* type of technology adoption framework (Al Khalil et al., 2017). Different countries have different contextual settings and not all frameworks are flexible enough for the contexts (Al-Hujran, Al-Lozi, Al-Debei, & Maqableh, 2018; Alkhalil et al., 2017). Another complication is the rate of change of technology and the impact this has on developing contexts (Palos-Sanchez, 2017). It can be argued that practical and realistically contextualised frameworks are scarce (N. Khan & Al-Yasiri, 2016). Zimbabwe requires, as already alluded to, a *home-grown* framework tailor-made to suit its unique characteristics.

This study outlined in this research document looks at developing a cloud adoption framework for SMEs in Zimbabwe. Such a framework can assist them in adopting cloud computing as a technological strategy and business strategy.

The research can contribute to the shortage of cloud computing adoption frameworks for SMEs in Zimbabwe. The framework is geared to address the adoption issues affecting SMEs. In addition, it can guide decision-making processes in the SME sector in Zimbabwe.

1.2 RATIONALE AND PURPOSE

Technology has ushered in new ways of doing business. With the right technology, organisations become competitive and penetrate any global market at any time (Adane, Piderit, & Herselman, 2019; Attaran & Woods, 2019; Palos-Sanchez, 2017). It is estimated that in most developing countries like Zimbabwe, five out of ten SMEs fail during the first five years of existence (Muriithi, 2017). In Zimbabwe, SMEs constitute 94% of the country's businesses population but surprisingly only contribute 15% to the country's economy due to a high mortality rate during the first five years (Sachikonye & Sibanda, 2016). Of all the SMEs in Zimbabwe, Sachikonye and Sibanda (2016) observe that 85% fail, 60% close within the first year, and about 25% during the first three years of operation. In Botswana, seventy per cent of SMEs fail within the first year of operation (Mafoko, 2019). In a study of five African countries, results show that most firms that start with between one (1) and five (5) employees, only less than one per cent (1%) grew to a size of about ten employees (Mutoko & Kapunda, 2017). Research attributes this massive failure rate to limited resources and intense market competition (Adane et al., 2019).

Adopting new technologies like cloud computing is said to solve some of the challenges SMEs are facing. Failure to embrace cloud computing is a threat to business sustainability and can result in a low economic throughput of a business in particular and the country in general.

Several theoretical frameworks have been developed to help both small and large organisations to adopt new technology. The tried and tested frameworks include Diffusion of Innovation (DOI), Technology Organisation Environment (TOE), and Theory of Planned Behaviour (TPB), among others. Additionally considering the Technology Acceptance Model (TAM). These frameworks have their strengths and weaknesses. Some studies have combined two or more of these frameworks (Gangwar, Date, & Ramaswamy, 2015; Oliveira, Thomas, & Espadanal, 2014; Yigitbasioglu, 2015) to complement each other's strengths. There is some benefit in combining the frameworks as it allows a better understanding of the things that affect the adoption of complex technologies of which cloud computing is an example. (Chiu & Liu, 2008).

Regardless of the availability of many technological adoption frameworks, the level of cloud computing adoption is still deficient in developing countries (Ez & Igbekele, 2019; Ray, 2016; Senarathna et al., 2018). Research has put up several reasons why organisations in developing countries still lag in as far as adopting new technology is concerned. Some cited reasons include lack of well-established ICT infrastructure (Adane et al., 2019; Attaran & Woods, 2019; M. Herselman & Botha, 2014); security concerns; lack of awareness of the new technology (Al-Hujran et al., 2018; Amini & Bakri, 2015; Attaran & Woods, 2019; Gangwar et al., 2015) and many other reasons. Generally, these reasons can be classified as technological, organisational or environmental. However, one primary reason that is often overlooked by research is the availability of a dozen adoption frameworks that confuse some organisations to pick the best fit framework to use in their situation. Besides, these frameworks were developed in one contextual setting and cannot be *copied and pasted* to another different setting.

Therefore, it is foolhardy to take a framework that was developed somewhere and apply it to the Zimbabwean environment. The technological, organisational and environmental adoption terrain in Zimbabwe requires a contextualised framework that SMEs can use in Zimbabwe. A few studies have been carried out on cloud computing adoption by educational and health institutions in Zimbabwe (Musungwini, Mugoniwa, Furusa, & Rebanowako, 2016), but none on SMEs. The lack of a contextualised framework can work as a barrier to cloud computing adoption.

Therefore, this study aims to develop a cloud adoption framework to assist SMEs in Zimbabwe to migrate to the cloud. In so doing, it can assist in improving their competitiveness nationally, regionally and globally.

The research questions and objectives that will guide the study are articulated below:

1.3 RESEARCH QUESTIONS AND OBJECTIVES

The research will set to answer the following questions.

1.3.1 Research Questions

The main research question (MRQ) is:

MRQ: What factors should be considered when developing a cloud computing adoption framework that supports strategic decision-making for SMEs' owners when adopting cloud computing in Zimbabwe?

The following sub-research questions (SRQs) will help answer the main question.

- SRQ1: Why is there a need, and what are the needs for SMEs to migrate their legacy systems to the cloud?
- SRQ2: What current cloud computing adoption frameworks exist that support strategic decision-making to adopt cloud computing and what are their shortcomings?
- SRQ3: What are the main tasks and steps that SMEs should perform when making the strategic choice to adopt cloud computing as an ICT solution?

- SRQ4: What are the influential factors in an organisation's decision to adopt cloud computing technology in Zimbabwean SMEs?

1.3.2 Research Objectives

The main research aim of this thesis is:

To develop a cloud computing adoption framework to assist SMEs in Zimbabwe to migrate to the cloud.

The main research objective is supported by the following sub-objectives (SO):

- SO1. To evaluate and identify the need for SMEs to migrate their legacy systems to the cloud.
- SO2. To evaluate the existing cloud computing adoption frameworks available for SMEs to use.
- SO3. To establish the main tasks and steps during the cloud adoption process.
- SO4. To develop a cloud computing framework to help SMEs in Zimbabwe adopt cloud computing as a technological and business strategy.

1.4 RESEARCH METHODOLOGY

This study uses the Design Science Research (DSR) methodology. DRS's research aims to describe and explain existing phenomena in the world and design and construct an artefact that will improve human capabilities and functionalities (Hevner & Chatterjee, 2010). DSR, according to Hevner and Chatterjee (2010), is used in software engineering, computer science and organisation science to develop artefacts that are used to solve human problems.

This research is concerned with developing a cloud adoption framework for SMEs in Zimbabwe to guide them during the cloud computing migration process. DSR is the best fit methodology to use to address the identified needs of SMEs in Zimbabwe. The IT adoption frameworks (DOI and TOE) in literature guided the development of the new framework. The frameworks were also used to formulate questionnaires and interviews questions. A purposeful sampling technique was used to gather information to improve or refine the framework in one of the cycles in DSR as a methodology in this research. More information is provided in Chapter 2 of this study.

1.5 ETHICAL CONSIDERATIONS

Ethics in research is concerned with doing what is acceptable and permissible (Oates, 2005). This research takes note of the following:

- The participants had to be informed about the study's purpose and voluntarily participate in the research.
- The research assured and ensured information confidentiality and anonymity of the participant.
- The researcher applied and was granted ethical clearance from UNISA (Appendix A).

1.6 RELEVANCE AND CONTRIBUTION

This research furthers the body of knowledge in that it develops a framework that can be utilised by SMEs in Zimbabwe when considering cloud computing. The contributions are mainly for the Zimbabwean context, but some pertain to other countries as well for example, the theoretical and methodological contributions can be applied in other countries. The research contributes to a theoretical, practical and methodological level**:**

The research contributes to the theory and, thus, the theoretical level by augmenting the current body of knowledge on cloud adoption frameworks towards assisting decision-makers in SMEs to migrate their legacy systems to the cloud.

The framework provides a method that guides decision-makers through a step-by-step approach, aiding them in migrating to the cloud. In addition, the method highlights important factors that act as a checklist to guide cloud computing implementers to evaluate their systems and see if they are ready to migrate to the cloud and thus adds a contribution at a methodological level.

At a ***practical*** level, the framework's use is expected to solve practical problems faced by SMEs in Zimbabwe to migrate their legacy systems to the cloud. The framework should inform the owners of SMEs, government and other stakeholders to create an enabling environment to encourage SMEs to migrate to the cloud. Cloud service providers are also going to benefit from understanding SMEs requirements and expectations, thereby enabling them to customise their offerings accordingly to meet the demands of different SMEs.

1.7 SCOPE AND LIMITATIONS

Participants in the study were purposefully sampled. The targeted participants are managers, owners of SMEs and anybody who makes decisions in the targeted organisations. The targeted organisations are SMEs with between one and fifty employees. The SME should also be located in Harare and Bulawayo regions and be registered with the Small and Medium Enterprises Association of Zimbabwe (SMEA-ZW). The richness of this research's findings will be limited to the data supplied by the targeted participants. The adage "What you see is what you get" aptly describes the limitations of this research's findings. The sample size and the use of interviews and the online survey to collect data from sampled SMEs present some limitations in generalising the study's findings.

1.8 CONCLUSION

This research will develop a CCAF (Cloud Computing Adoption Framework) that SMEs could use in Zimbabwe so that they can move their legacy systems to the cloud. Studies show that many cloud computing frameworks were developed in different contextual settings, and none were developed in Zimbabwe. Different countries are at varying levels of economic, political, social and technological development. There is no *one size fit all* type of framework that can be used *as-is* in another different setting. It would be imprudent for SMEs in Zimbabwe to use a framework developed in a different contextual setting from SMEs operating in Zimbabwe. Lack of a locally produced framework is actually a barrier to cloud computing adoption.

A Design Science Research (DSR) approach is used, and data were collected from purposely sampled SMEs in Zimbabwe. This project is expected to guide and encourage the SME community in Zimbabwe to adopt cloud computing. The research framework produced from the research is an artefact that can help the government of Zimbabwe and other stakeholders to promote an enabling environment that promotes the up take of cloud computing by SMEs. CC offers a competitive advantage and allows organisations to be visible in the global markets.

This research's contribution is at three different levels: methodological, theoretical and practical levels.

1.9 THE ORGANISATION OF THE THESIS

As shown in Figure 1.1, the organisation of the thesis gives an overview of the chapters of the thesis. This thesis contains seven chapters. A flow diagram will be presented at the beginning of each chapter and some narration of the chapter's essential discussion points.

Chapter 1 gives the background, rationale and purpose for carrying out this study. The chapter states and outlines the following: The articulation of the research questions and objectives, research methodology, relevance, and research contribution.

Chapter 2 discusses in detail with reasons for the chosen research methodology. The research philosophies are also discussed.

Chapter 3 is a literature review on SMEs' role in developing and highlights some of the challenges faced.

Chapter 4 discusses the literature review that was on cloud computing and looks at CCAF.. A theoretical, conceptual adoption framework is also presented.

Chapter 5 presents data and results of qualitative analysis.

Chapter 6 presents data and results of quantitative analysis.

Chapter 7 presents a discussion of the results of the study.

Chapter 8 gives a research overview, contributions, limitations, future research and conclusions.

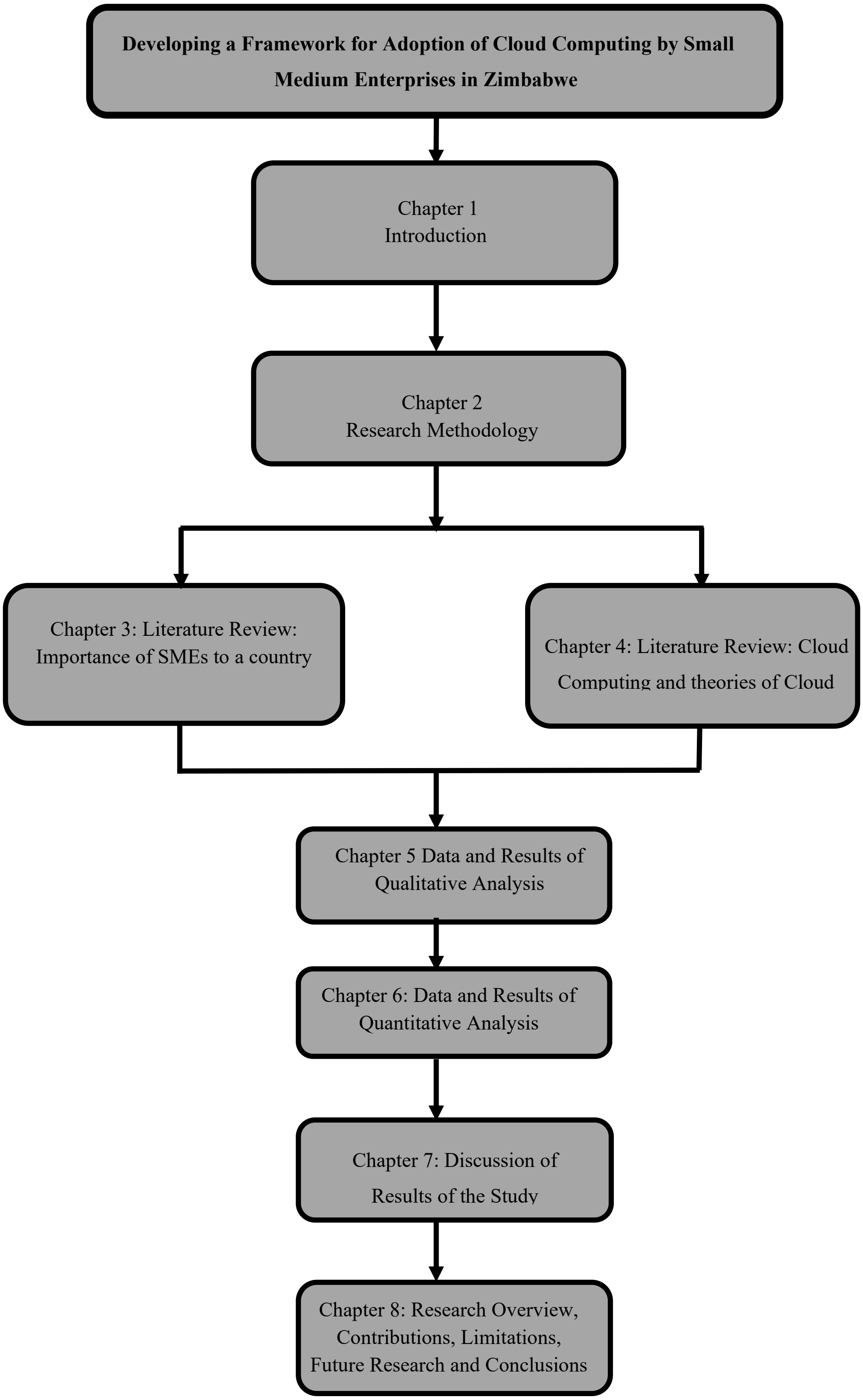

Figure 1-1: Organisation of the Thesis.

CHAPTER 2 RESEARCH METHODOLOGY

2.1 INTRODUCTION

The research context, research topic, research questions, and aims for this study were all discussed in detail in Chapter 1. The objective of this chapter is to identify and explore the philosophical assumptions that serve as the foundation for this research project. Detailed research methodology, research strategies, data collection and data analysis methodologies, and sample strategies are discussed in this chapter to address the research questions provided in Chapter 1 of this book. This section describes the research technique, which describes how the study will be conducted to answer the research questions. The Design Science Research Approach, according to this chapter, is the best appropriate methodology for this study's objectives (DSRM). Because it is a practical and solution-oriented methodology, DSRM assists in developing artefacts that are designed to solve human issues (Hevner & Chatterjee, 2010). The purpose of this study is to establish a cloud computing adoption framework to address the challenges that SMEs in Zimbabwe face while attempting to adopt cloud computing. The process of constructing the framework (artefact) is realistic, and as a result, DSRM is the most appropriate method to apply to tackle this issue. Section 2.6 of this chapter explains the research approach that was chosen for this study.

2.2 MAPPING DSR METHODOLOGY INTO THE RESEARCH

The following table details how this study maps into DSRM proposed by Peffers, Tuunanen, Rothenberger, and Chatterjee (2007).

Table 2-1: Mapping the study to the Peffers et al. DSRM process

Main research question	The section in the research	Peffers et al. (2007) Research Process	Chapters
What factors should be considered when developing a cloud computing adoption framework that supports strategic decision-making for SMEs' owners when adopting cloud computing?	1.2 Rational and purpose	Problem identification and motivation	Chapter 1
	1.4 Research questions and objectives	Objectives of the solution	Chapter 1
	Chapter 2: Research methodology; Chapters 3 and 4 Literature review	Design and development	Chapters 1, 2, 3, 4, 5 and 6
	Findings and analysis	Demonstration	Chapter 6
	Proposed cloud computing framework	Evaluation	Chapters 5, 6 and 7
	Summary, reflections and conclusions	Communication	Chapter 8

These are the sections that will be covered: Section 2.3 discusses various research paradigms. After outlining philosophical assumptions, Section 2.5 highlights and supports the philosophical underpinning of this investigation. Sections 2.6 and 2.7 provide an explanation and justification for the adoption of DSRM as a methodology for this investigation. Section 2.8 provides a detailed description of the research strategy employed in this study, while Section 2.9 provides an overview of the use of DSRM in this investigation. It also describes how the four-cycle concept of DSRM suggested by Drechsler and Hevner (2016) corresponds to the findings of this investigation. Section 2.10 covers the application of DSRM to this particular investigation in further detail. This study is described in Section 2.11, which highlights the contribution of DSR to it, while Sections 2.12 and 2.13 provide an overview of the data gathering methods and data analysis methodologies used in this study, respectively. Following are the sections: 2.14 triangulation, 2.15 population and sampling, 2.16 appraisal of the artefact, 2.17 ethical issues, and 2.18 conclusion, in that order. As previously stated, the following are examples of Section 2.3 discusses the many research paradigms available.

2.3 RESEARCH PARADIGMS

The research paradigms are critical to any study because they aid in describing the philosophical underpinnings of particular groups of people and the world in which they live (Oates, 2005). The research paradigm represents the researcher's views about the world in which he or she lives or wishes to live (Kivunja & Kuyini, 2017). Thus, the study's philosophy and research paradigms are determined by the researchers' personal views of the world and the experience gained via culture and training. According to (Hopkins, Regehr, & Pratt, 2017), defining one's philosophical perspective is critical because it affects how one perceives the world. A paradigm is a set of fundamental views or a philosophical premise that guides the researcher's activities or beliefs and defines their worldview (Denzin & Lincoln, 2011; Kaushik & Walsh, 2019). According to Kaushik and Walsh (2019, p. 26), a paradigm is "a fundamental set of beliefs or worldview that directs research action or enquiry." Both definitions indicate that a paradigm is the researcher's perspective. Thus, the researcher's perspective on the world greatly impacts how the research is conducted. In research, paradigms impact what should be examined, how it should be studied, and how the research findings should be evaluated (Kivunja & Kuyini, 2017). Each paradigm comprises four basic components: axiology, ontology, epistemology, and methodology (Kaushik & Walsh, 2019). These factors define each paradigm's fundamental assumptions, beliefs, norms, and values, described in Section 2. 3. Interpretivism, positivism, pragmatism, and critical realism are the four dominant philosophical paradigms in IS. The paradigms are summarized below.

2.3.1 Interpretive Research Paradigm

This paradigm presupposes that reality is comprehended through social constructs (language, instruments, and perceptions) and subjective interpretations of human behaviour (Myers, 2009; Oates, 2005; Terre Blanche, Durrheim, & Painter, 2006). Our world is a social construct that human actors build (Chowdhury, 2014). To provide a realistic and accurate depiction of their reality, a researcher should put themselves in the subjects' shoes and view the world through their eyes (Chowdhury, 2014; Moon & Blackman, 2014). Thus, interpretivism requires researchers to admit their degree of engagement throughout the research process. Interpretivism typically uses qualitative research methodologies such as case studies, action research, interviews, and observations to comprehend the context (Oates, 2005). This paradigm is applicable to the study of complicated human behaviour (Gregor & Hevner, 2013).

2.3.2 Critical Research Paradigm

In this research paradigm, research is performed in similar contextual settings as interpretivism research, but the researcher challenges the current social settings (political, cultural, economic, technological settings) (Moon & Blackman, 2014). It identifies social structures, policies, beliefs and practices that are unjust in the society and helps to transform them (PC Taylor & Medina, 2013). The critical research paradigm identifies and tries to resolve societal power imbalances that contribute to inequalities and injustices (PC Taylor & Medina, 2013). The researcher would aim to change and improve the status quo of things in society. For example, the researcher can challenge the technological imbalances between multinational companies and SMEs in Zimbabwe. The challenges can usher in a new era of equal opportunities to access technology. Qualitative methods such as action research, ethnography and case studies are used in this research paradigm (Adebesin, Kotzé, & Gelderblom, 2011; Oates, 2006).

2.3.3 Positivist Research Paradigm

This paradigm asserts that reality can be objectively described and measured. It assumes that the world exists independently of subjective interpretation (Oates, 2006), and researchers can objectively study it. Positivist researchers are independent of and neither affected by subjects under research (Saunders, Lewis, & Thornhill, 2012). Positivists prefer to work with observable social reality, and the end product of research can be generalised and applied to similar situations elsewhere (Oates, 2006; Saunders et al., 2012). Some studies criticise the tenets of positivism paradigm for being shallow and not taking into account the subjective nature of human reasoning (Moon & Blackman, 2014). Positivist research collects quantifiable data; experiments and questionnaires are typical methods used in this research paradigm.

2.3.4 Pragmatism

Without respect for its ideology, pragmatism says that research should be developed and executed in the most efficient manner to address the research issue (Biddle & Schafft, 2015; Creswell & Plano Clark, 2011; Maarouf, 2019). McKay and Marshall (2008) emphasize that when researchers employ pragmatism as a research paradigm, they are free to employ whatever philosophical or methodological approach that is appropriate for the study challenge at hand. According to several studies, pragmatism is a philosophy that permits the incorporation of disparate paradigms, data collection methodologies, and data analysis (Biddle & Schafft, 2015; Creswell & Plano Clark, 2011; Kaushik & Walsh, 2019; Maarouf, 2019).

According to Maarouf (2019), pragmatism is intersubjective, which means it is both subjective and objective at the same time because it acknowledges the presence of a single reality while allowing for diverse interpretations of that reality. Thus, reality interpretation is contingent upon one's experiences and contextual environment (Saunders, Lewis, & Thornhill, 2016).

Pragmatism maintains that no two people have identical worldview experiences (Kaushik & Walsh, 2019). Thus, it is critical to investigate social actors' worldviews (perceptions) in order to have a thorough understanding of the context in which they operate (Maarouf, 2019), given that reality is not continuous but changes with the situation. According to Biesta (2010), pragmatism is a mixed methods research strategy, which is explained in part by its utility as a philosophical vehicle for addressing many of the harmful dualisms at the heart of the "paradigm wars". This research utilized a combination of approaches with a pragmatic orientation. Numerous investigations have established that pragmatism is the guiding philosophy of DSR (Deng & Ji, 2018; Goldkuhl, 2012; Parvaiz, Mufti, & Wahab, 2016). The framework was designed in accordance with Peffers et al (2007).design's methodology

Interpretivism was mostly employed in Phases 1 and 2, while positivism was primarily used in Phase 3, when web-based questionnaires from SMEs were collected. The purpose of this study is to build a framework for SME cloud computing adoption by first identifying the characteristics that motivate SME cloud computing adoption.

2.4 PHILOSOPHICAL ASSUMPTIONS

In Information Technology (IT) and Information Systems (IS), paradigms help guide the research and are crucial in designing, constructing, and implementing systems. Myers (2009) observed that philosophical assumptions influence the choice of a research paradigm selected by the researcher. There are four common philosophical groundings used in IS and IT research: Ontology, Epistemology, Methodology and Axiology. These are explained below.

2.4.1 **Ontology**

It is concerned with what kind of the world we are investigating, that is, the nature of reality (Kivunja & Kuyini, 2017). Reality is contextual, that is, a reality in one environment may be fiction in another. Reality is formed via the process of transformation. Ontology affects how a researcher reports a fact within a particular field of study (Oates, 2006). For example, positivists believe that it is possible to objectively and independently observe and quantify reality or phenomena in the world.

On the other hand, interpretivists argue that reality is impermanent and incapable of quantification (Dietz, 2006; Oates, 2006). According to interpretivists, reality must be interpreted in light of the contextual aspects present in the environment (Terre Blanche et al., 2006). According to Lincoln and Guba (1990, p. 83), ontological assumptions are those that can address the questions 'what is known?' or 'what is the nature of reality?' Ontology, as defined by Kivunja and Kuyini (2017), is concerned with the assumptions we make in order to believe something is real or makes sense. A researcher's beliefs about the nature of reality are critical because they assist the researcher in making sense of the obtained evidence (Kivunja and Kuyini, 2017). Depending on the research paradigm, the researcher should employ appropriate procedures and strategies to disentangle "reality" from the research setting. This research will establish a framework for cloud computing adoption that will assist SMEs in Zimbabwe in migrating to the cloud. It is critical, therefore, to understand the contexts in which SMEs operate. This would enable the research to disentangle "truth" from contextual influences and encourage SMEs toward cloud computing as a business strategy.

2.4.2 **Epistemology**

Saunders et al. (2019) and Burrell and Morgan (2017) define epistemology as beliefs about knowledge, what constitutes legitimate and acceptable knowledge, and how such information can be transmitted to others. Epistemology, according to Kivunja and Kuyini (2017), is the study of the nature of knowledge and justification. In other words, it is a method for comprehending and describing how we come to know what we do (Oates, 2006). Epistemology refers to the method by which a researcher conveys the truth regarding acquired knowledge (Kaushik & Walsh, 2019). The report's data may be numerical, written, or graphic. According to Vaishnavi, Kuechler, and Petter (2019, p. 8), Design Science Research is an epistemology of "knowing by producing" that contextualizes the researcher-artefact connection.

2.4.3 **Methodology**

The methodology is like a toolkit that the researcher uses to investigate a phenomenon (Wahyuni, 2012). The methodology is a broad field that includes data gathering, participants, instruments used to gather data and the analysis applied to the data. Kivunja and Kuyini (2017) define methodology as a broad term incorporating research design, approaches, and procedures to answer a research question. In this research, the methodology includes all the procedures and approaches used to describe how the artefact is designed, developed and constructed.

The ontology, epistemology and methodology of this research are discussed in the section below. However, first, a summary of research paradigms and philosophical assumptions are presented in Table 2.2 below.

A summary of philosophical assumptions of the four research paradigms (Saunders et al., 2019; Vaishnavi et al., 2013) is provided in the table below.

Table 2-2: Summary of Philosophical assumptions in research paradigms

	Philosophical assumptions		
Research paradigms	Ontology (nature of reality)	Epistemology (what constitutes acceptable knowledge)	Methodology (how to design an artefact)
Positivism	- there is a single, stable reality - it is law-like	- objective - researcher acts as an observer, not attached	- experimental - quantitative - hypothesis-testing -statistical
Interpretivism	- reality is contextual therefore, there are multiple realities and can be socially constructed	- the researcher gets into the shoes of the research subjects to understand their way of life. - the researcher or observer is not neutral but subjective	- interactional - interpretation - qualitative -hermeneutical -dialectical
Critical realism	- reality can be socially constructed	- suspicious - political - the researcher is critically involved in empowering subjects.	- deconstruction - textual analysis - discourse analysis
Pragmatism	Complex, rich external 'reality' is the practical consequences of ideas. -the flux of or processes, experiences and practices.	-the practical meaning of knowledge in a specific context. -knowledge is based on experiences. -focus is on problems, practices and relevance. -the contribution to problem-solving and informed future practice.	-range of methods: mixed, multiple qualitative, quantitative, action research. The emphasis is on practical solutions and outcomes.

Pragmatism research paradigm was selected for this study as indicated in the highlighted section of Table 2.2. DSR is used to develop and design artefacts that solve people's problems (Vaishnavi et al., 2019).

Ontologically the SMEs targeted in this study have different lines of trade and, therefore, have different worldviews. During the Design Research (DR) cycle, contextual factors should be taken into account to capture different business sectors' unique reality. A multiplicity of views from different stakeholders in the SMEs industry was taken into account and analysed. Reality changes according to the context and perceptions of individual decision-makers in these different SMEs. Also, there are no two SMEs that experience the same challenges and solve them the same way. To understand these challenges, it was essential to objectively and contextually study the unique challenges faced by different SMEs in Zimbabwe.

Epistemologically, no two SMEs experience similar challenges and explain these challenges the same way. SMEs in Zimbabwe must be competitive to reach the global markets. Unfortunately, these SMEs are hamstrung by a myriad of challenges. To understand these challenges, they need to be objectively tested and contextually explained by decision-makers in these SMEs. Every decision-maker in the SMEs has a story to tell about the challenges they face. Usually, this depends on the industry, experience, and unique environment in which they conduct their business. These SMEs' challenges could be objectively explained, but there was a need to understand the context in which they operate. Therefore, the researcher had to understand the context in which these SMEs operate to appreciate the challenges they face. Furthermore, with DSR, the knowledge initiated or obtained in one phase or sub-cycle created awareness of the inputs to commence the next phase.

Methodologically, using a design science research method, a cloud computing framework will be developed as an artefact to guide SMEs in Zimbabwe to migrate their legacy systems to the cloud. The emphasis is on practical solutions and outcomes; hence a range of data collection methods are used for this study, namely questionnaires, interviews and observations (from literature reviews).

Axiologically, the artefact should guide SMEs in Zimbabwe to migrate to cloud computing to be competitive in the global markets. In this research, the artefact was the cloud computing adoption framework. To construct the cloud adoption framework, the context in which SMEs operate needs to be well understood to interpret the participants' feedback correctly. During interviews, the participants were treated with respect and integrity. The views of the participants from both the interviews and questionnaires were treated with confidentiality.

2.5 PHILOSOPHICAL GROUNDING FOR THIS STUDY

As already noted in Table 2.2, the applicable research paradigm for this study is pragmatism. The project created a framework for SMEs in Zimbabwe to use cloud computing. This framework is meant to encourage small and medium-sized businesses to use cloud computing as a technology and business strategy. A practical issue is the absence of a cloud computing adoption framework. existing in Zimbabwe. Pragmatism is the best research paradigm to use for this study because the paradigm can be applied to provide solutions to practical problems in the real world (Creswell & Plano Clark, 2011; Shannon-Baker, 2016). According to Cornish and Gillespie (2009, p. 6), pragmatism "builds knowledge through practical activity". da Silva, de Oliveira Siqueira, Araújo, and Dornelas (2018) add that pragmatism is a philosophy that considers things from a practical point of view. Developing a cloud computing adoption framework is a practical activity that can be supported by the pragmatism research paradigm.

According to pragmatism, the critical points to consider in sound scientific research are action and relevance (da Silva et al., 2018). The development of the cloud adoption framework is a practical activity propounded by pragmatism and very relevant to SMEs in Zimbabwe to enhance their global competitiveness.

According to da Silva et al. (2018), pragmatism is classified as a multifaceted research philosophy. It takes up several paradigmatic philosophical positions such as interpretivism, critical, positivism and constructivism, among many other positions. Pragmatism gives the researcher degrees of freedom to select the most appropriate research philosophy to answer the research question adequately. Furthermore, the researcher will not be a prisoner to one particular research methodology because pragmatism gives researchers the flexibility to use quantitative and qualitative research methodologies (da Silva et al., 2018; Robson & McCartan, 2016).

Pragmatism is described as appropriate when dealing with organisational change and constructing artefacts (Goldkuhl, 2012). This statement aptly fits nicely into this study's aim to develop a cloud adoption framework for SMEs in Zimbabwe. Obviously, from this aim, the framework is the artefact, and the change that comes within SMEs cloud computing adoption represents organisational change. This study used the Design Science Research Methodology (DSRM) to develop this framework. Many studies argue that pragmatism is the underpinning philosophy of DSR methodology (Deng & Ji, 2018; Goldkuhl, 2012; March & Storey, 2008; Parvaiz et al., 2016).

Pragmatism which builds knowledge through practical activity (Cornish & Gillespie, 2009) has been known to work well for studies that adopt DSR as research methodology (March & Storey, 2008). A. S. Lee and Nickerson (2010) also add that pragmatism is the most appropriate research paradigm when conducting design science research.

2.6 DESIGN SCIENCE RESEARCH (DSR)

DSR, for many decades, has been used in engineering and IS research under different names (Elragal & Haddara, 2019). DSR has, over the years, been used to create new artefacts or innovations to solve human problems. There are different views about the contributions of DSR in the IS field. Some researchers argue that DSR should contribute to both the artefact and theory. In contrast, others argue that artefact is the only noteworthy contribution of DSR, yet others posit that theory is the most crucial contribution of DSR (Baskerville, Baiyere, Gregor, Hevner, & Rossi, 2018; Elragal & Haddara, 2019).

In terms of what comes first artefact or theory in DSR methodology, some scholars argue that IT artefacts should proceed with the design theories (Baskerville et al., 2018; Elragal & Haddara, 2019). They reason that it is only after IT artefact realised that researchers have time to reflect and generate the design theories (Baskerville et al., 2018). The proponents of this assertion further argue that most artefacts result from creative insights or "eureka moments where the inventor has a sudden flash of inspiration" (Baskerville et al., 2018, p. 364). In such cases, theoretical design can only come after the artefact has been constructed. However, some studies suggest that both theory and artefact should be produced at the same time. Elragal and Haddara (2019, p. 3) posit that “during the creation process, the researcher must be aware of progressing both the design process (theory) and the design artefact as part of the research.”

While the focal point of IS research should be the construction of an artefact, some studies argue that it is also essential to be open to "multiple, emergent and dynamic properties of the IT artefact" (Baskerville et al., 2018, p. 362; da Silva et al., 2018; Elragal & Haddara, 2019). Thus, DSR should focus on building an artefact and contribute to knowledge building and rigorous ways to evaluate IT artefacts (Venable, Pries-Heje, & Baskerville, 2016).

Based on the dissertation's objective, to develop a cloud computing adoption framework to help SMEs migrate their systems to the cloud, the following section below explains why DSR was chosen for this research.

2.7 RESEARCH METHODOLOGY AND JUSTIFICATION FOR ITS USE

As previously stated, the research methodology for this study is the Design Science Research Methodology (DSRM). DSRM is defined differently by different scholars. Design science research, according to (Hevner & Chatterjee, 2010, p. 5), is a research methodology "in which a designer answers questions relevant to human problems through the creation of innovative artefacts, thereby contributing new knowledge to the body of scientific evidence." What is important to note from this definition is that DSRM contributes new knowledge to the body of scientific evidence while solving relevant or current human problems. These are two fundamental principles of DSR methodology. Design-based research methodology (DSRM) is a research methodology that employs design as a research technique (Vaishnavi et al., 2019). DSRM is defined by Montero and Kapinga (2019, p. 486) as "a methodology that uses design as a tool for the development of both practical and theoretical types of research resulting in an artefact and theoretical scientific knowledge." In IS, DSRM is concerned with developing a solution to commonplace problems, which some studies refer to as wicked problems (Hevner & Chatterjee, 2010; Vaishnavi et al., 2019). Wicked problems, according to Hevner and Chatterjee (2010, p. 11), are "ill-defined environmental contexts as well as the creativity and teamwork required to produce effective solutions." The definition implies that wicked problems are maze-like problems with no definite structure; there are no exact starting or ending points in the problem. Another feature of wicked problems is a "high degree of uncertainty as to how the problem should be approached and the set of alternative solutions" (Pries-Heje & Baskerville, 2008, p. 73).

The description of wicked problems directly contributes to the goal of this research, which is to develop a cloud computing adoption framework for SMEs in Zimbabwe. Adoption is a difficult process in and of itself because a variety of factors influences it.

DSR addresses complex information-systems problems by combining human and technological components (Baskerville et al., 2018). These complex issues are difficult, if not impossible, to decompose and comprehend. Through multiple DSR iterations, DSR should streamline and construct the problem and propose a solution (Baskerville et al., 2018; Hevner, 2007). Iterations consist of build and evaluating steps that culminate in a solution to the identified problem.The aim of DSR in research is to describe and explain existing phenomena in the world and design and construct an artefact that will improve human capabilities and functionalities (Hevner & Chatterjee, 2010; A. Hevner & S. Chatterjee, 2010; Vaishnavi et al., 2019). DSR, according to Hevner and Chatterjee (2010), is used in software engineering, computer science and organisation science to develop artefacts that are used to solve human problems.

DSR produces different artefacts or products, including but not limited to models, improvement of an existing artefact, constructs, concepts, and many other forms of artefacts (A. Hevner &

S. Chatterjee, 2010). The design and creation of artefacts in DSR, according to Hevner (2007), broaden not only human organisational problem-solving horizons but also shape theory development regarding artefacts. Johannesson and Perjons (2014) support the assertion when they posit that the outcome of design research science is not only an artefact but also conceptual knowledge about the artefact. According to Peffers et al. (2007), DSRM helps develop the artefact and, at the same time, produce a well-documented good knowledge base that different professionals can use to design solutions to solve their problems.

The goal of this study is to create a cloud adoption framework that SMEs can use to guide them through the cloud computing migration process. According to Hevner (2007), IS research should use systems and technology to identify needs in an organizational environment that affect people. DSR is the best fit methodology for successfully addressing an organization's identified cloud computing adoption needs. Furthermore, Zimbabwean SMEs require a locally developed cloud computing framework that considers contextual factors such as economic, technological, and political development levels.

The DSRM's core research products are well-tested, well understood, and documented generic designs that have practical relevance in people's lives. Van Aken, Chandrasekaran, and Halman (2016, p. 5) define generic design as a "design that can be transferred to contexts other than the ones in which it has been made and tested without losing its basic effectiveness." This research aims to develop a generic framework, which should be used by any SME regardless of line of trade.

DSRM has a structured approach to solving human problems. It starts from problem identification, statement of objectives and other iterative processes up to the last stage of communicating a product to the users (Johannesson & Perjons, 2014; Peffers et al., 2007; Vaishnavi et al., 2019) . Thus, DSR was chosen for this research because it is simple and laid out to cover the critical components of cloud adoption framework (artefact) development (Coltman, Tallon, Sharma, & Queiroz, 2015; McLaren, Head, Yuan, & Chan, 2011). In a way, DSR empowers and enables organisations to make informed cloud adoption decisions in this day and age infested with a labyrinth of problems. Peffers et al. (2007) term "wicked problems" as already described above. DSR can help SMEs see where they are and where they want to migrate their legacy systems to the cloud when followed to the dot. The beauty of DSR is that it comprises aspects of the product (output) and process. Above all, Vaishnavi et al. (2019) term DSR as “knowledge building through doing.”

Some researchers argue that DSRM, as a research methodology, represents a natural approach to solving life problems (Vaishnavi et al., 2019; Van Aken et al., 2016). Naturally, when confronted with a problem, they have to understand the nature of the problem, analyse the problem and design a solution. All these processes are part of the DSR research methodology. The proposed solution is then broken down into smaller interconnected chunks that undergo cycles of testing and redesign (Van Aken et al., 2016) until a "perfect solution" is achieved.

DSR methodology is made up of three key components: conceptual principles that define the research methodology, practice rules, and a research process (Peffers et al., 2007). DSR methodology stands out as a methodology in IS research because of the essential components. It is also worth noting that some researchers regard DSRM as a multifaceted methodology that provides researchers with various research tools (Drechsler & Hevner, 2016; Hevner & Chatterjee, 2010; Hevner, March, Park, & Ram, 2004). DSRM can collect data through interviews, observations, questionnaires, focus groups, and various other methods. As a result, it gives the researcher the freedom to select the best tools to adequately answer the research question. Using a variety of data collection tools contributes to the rigour, validity, and dependability of the research findings.

According to March and Storey (2008), DSRM can be used in the following scenarios: • When the researcher demonstrates that no suitable method exists to solve the research problem.

• When the problem at hand is pertinent.

• When there are developments and presentations of a new artefact that will aid in the resolution of the current problem.

• When the research adds to the existing theoretical body of knowledge and has the potential to assist SMEs in Zimbabwe in adopting cloud computing.

This research possesses all the above recommendations by March and Storey (2008). The lack of a cloud adoption framework for SMEs is a real and relevant problem that must be solved.

2.7.1 Rigour Challenges

Generally, artefacts developed in DSR methodology undergo purposeful evaluation. The evaluation process is deemed necessary in testing the rigour of DSRM. The evaluation provides the feedback required to redefine the characteristics of the artefact. Some studies argue that DSR evaluations are complex since artefact is "tightly coupled to its desired use and purpose"

(Elragal & Haddara, 2019, p. 3; Hevner et al., 2004). Since there is a diversity of artefacts produced in DSR, it is “difficult to find solid guidelines on selecting, designing and implementing an appropriate evaluation strategy” (Elragal & Haddara, 2019, p. 3) for each artefact.

Elragal and Haddara (2019) propose the following evaluation guidelines:

• If the goal of DSRM is to generate design theories, then the proposed hypothesis should be tested by experiments.

• If DSRM is to create a system or process, the demonstration is utilized as an evaluation strategy.

Laboratory experiments, field experts, pilot testing, simulations, expert reviews, and field experiments should all be used to evaluate the results of design-oriented research.

Elragal and Haddara (2019, p. 3) also state that "since the artefacts are purposeful, the continuous evaluation of the artefacts in DSR during their creation process is deemed critical in conducting rigorous DSR." Continuous evaluation provides a better understanding of the problem at hand as well as the necessary feedback to improve the artefact's quality. DSR rigorous evaluation ensures that the artefact is serving its intended purpose.

According to Baskerville et al. (2018), artefacts can be examined in a real-world setting by trial and error. Evaluating an artefact in context aids in identifying and correcting problems in the artefact as they occur. This study evaluates the cloud adoption framework using the second and third criteria from Elragal and Haddara (2019). The artefact was assessed using multilinear regression analysis. The next section describes the research strategy for this study.

2.8 RESEARCH STRATEGY

A research strategy, according to Johannesson and Perjons (2014), is a comprehensive plan for performing research. It is critical in research since it directs the researcher's planning, execution, and monitoring of the study (Johannesson & Perjons, 2014). The plan outlines the steps necessary to assemble the data necessary to answer the research question (Baran & Janice, 2019). Action Research (AR) and Design Research (DR) are the two primary strategies that are frequently employed in DSR (DR). These two options are discussed briefly below.

2.8.1 **Action Research (AR) strategy**

While Action Research is typically case-specific, Design Research contributes to the development of generic knowledge that may be applied to a variety of organizations (Van Aken et al., 2016). According to Johannesson and Perjons (2014, p. 49), Action Research is a "method for resolving practical issues that arise in real-world contexts." Action research is performed to ascertain the problem's contextual setting and to effect desired changes (Bradbury-Huang, 2010). One difficulty with action research is that the findings are difficult to generalize because they are related to a single local practice (Johannesson & Perjons, 2014).

2.8.2 **Design Research (DR) strategy**

A design research strategy is one that focuses on the process of creating, producing, or upgrading an artefact (Johannesson & Perjons, 2014; Oates, 2006; Van Aken et al., 2016). It is a hands-on approach in which one learns by doing (Hevner et al., 2004; Vaishnavi et al., 2019). This research employed the DSR technique because it aimed to create a cloud computing framework (artefact) that SMEs could utilize to move their legacy systems to the cloud. To address the research question, both qualitative and quantitative data were acquired. As detailed below and somewhat summarized in Figure 2, the research was conducted in three phases: Phase 1, Phase 2, and Phase 3. 1

- **o Phase 1**

This phase is discussed in further detail in Chapters 3 and 4 of this study. This phase is devoted to conducting a literature review. Boell and Cecez-Kecmanovic (2014) recognize the value of doing a literature review as a research method in and of itself. The literature contains an enormous amount of knowledge about a particular subject, providing a foundation for any subsequent research (Oates, 2006; Schryen, 2015). A literature review can also assist identify knowledge gaps that need to be filled or closed (Rowe, 2014).

A review of literature shows that there are several cloud computing adoption frameworks. This study is anchored on DOI and TOE frameworks. The two frameworks have extensively been used in many similar previous studies (Abdul Hameed & Arachchilage, 2017; Palos-Sanchez, 2017; Senarathna et al., 2018; Varma, 2019). Factors affecting cloud adoption by SMEs in developing and developed countries were extracted from the literature review. Identified cloud adoption factors from the DOI and TOE frameworks were put together to develop the initial cloud computing adoption framework, which SMEs could potentially use in Zimbabwe to adopt cloud computing. However, to develop an acceptable cloud adoption framework, it was essential to understand and examine factors that influence SMEs' cloud adoption. Thus, this study was the first one of its kind. It was imperative to review several literature sources that included books, newspaper reports, journals, conference proceeding papers, theses, dissertations and the Internet to understand factors that affect cloud adoption. All the used resources were referenced correctly throughout this study.

- **Phase 2**

This phase elicited perspectives from managers, owners, and chief executives in a sample of Harare and Bulawayo SMEs. These individuals were chosen because they are in charge of making cloud computing adoption decisions in their organizations. This phase collected data mostly through semi-structured telephone interviews. Twelve (12) carefully selected SMEs were interviewed in Harare and Bulawayo, as these cities are home to the majority of Zimbabwe's SMEs. This phase's findings resulted in the creation of an intermediate cloud adoption framework.

- **Phase 3**

This phase utilized the findings from Phase 2 to develop a web-based questionnaire. In Phase 2, the questionnaire was used to validate the findings. Thus, Phase 3 intends to further develop the Phase 2 architecture for intermediate cloud adoption. The framework will be validated using MLR analysis, culminating in the final cloud computing adoption framework for SMEs in Zimbabwe. (Figure 2.5 summarizes the design research technique used in this project.)

The rationale for utilizing two phases, qualitative and quantitative, is discussed below.

2.8.2.1 *Justification for the adoption of a mixed-methods approach to data collection*

Olivier (2017) asserts that combining qualitative and quantitative data collection methods results in more details and eliminates inherent biases in both qualitative and quantitative data collection approaches. According to (Creswell & Poth, 2016), a mixed method is a procedure that combines qualitative and quantitative data gathering and analysis in a single study in order to answer the research question adequately.

Candela et al. (2015) encourage IS researchers to use diverse data collection strategies to answer challenging research issues. Nobody knows how to collect data on wicked challenges like establishing a cloud adoption framework. The study's goal was to establish a cloud computing adoption framework for SMEs in Zimbabwe, hence varied data gathering methods were used. In order to grasp the depth of the obstacles experienced by SMEs in adopting cloud computing, we used both quantitative and qualitative methods to reach out to a broad sample of participants. Quantitative and qualitative approaches are "epistemologically coherent and useful for verification as well as generalisation of findings," say Jogulu and Pansiri (2011, p. To contextualise and generalise the study findings, this study used mixed approaches (Venkatesh, Morris, Davis, & Davis, 2003).

The figure below is a summary of Phases 2 and 3 data collection procedures.

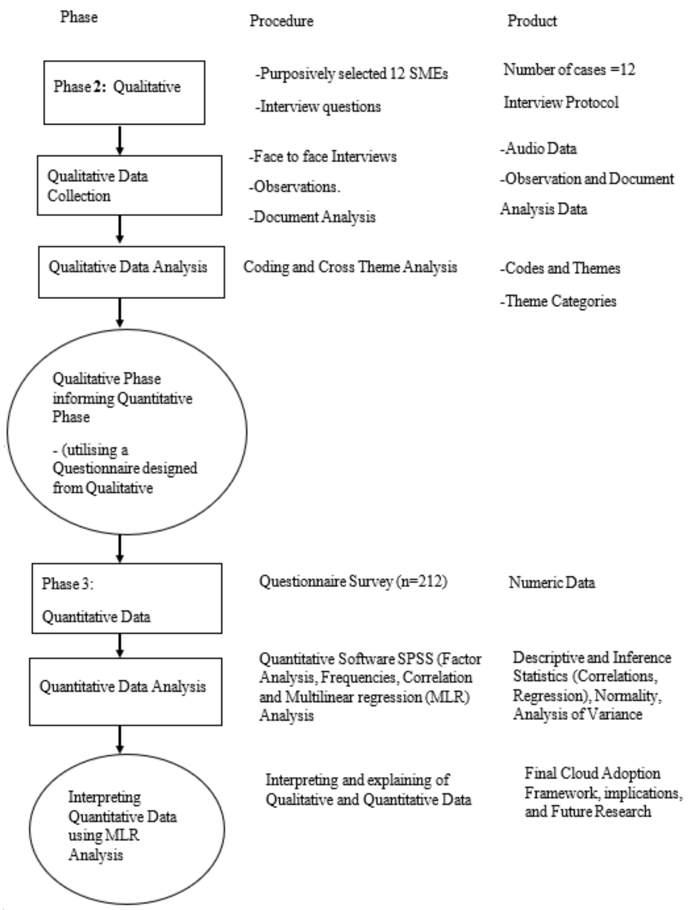

Figure 2-1: Model for Mixed Method Data Collection Procedures [Adapted from Ivankova and Stick (2007, p. 98)].

In Figure 2.1: Qualitative data collecting methods for SMEs. Antwi and Hamza (2015) claim that the meaning of a phenomenon is contained in the consumers' experiences. That is why qualitative data gathering would likely yield a detailed account of the problems faced by SMEs in Zimbabwe while adopting cloud computing. There is no current literature on cloud adoption for SMEs in Zimbabwe. Antwi and Hamza (2015) advise utilizing a qualitative method when minimal information about the occurrence is available. Collins, Onwuegbuzie, and Sutton (2006) propose starting with a qualitative method to gather rich data that would shape the design of a questionnaire utilized later in the quantitative part of the study. The results of the qualitative stage (Phase 2) were used to develop the quantitative stage questionnaire (Phase 3). As stated previously, the themes for the two stages came from the DOI and TOE frameworks. Phase 2 generated an intermediate cloud computing adoption framework, while Phase 3 delivered the final framework, validated using MLR.

Some natural and social scientists have criticized DSRM for its lack of transparency in making artefacts and contributing to knowledge development (Baskerville et al., 2018). They propose a high-level design outline or a template to perform DSR. It should be followed by all DSR methods with slight modifications. The high-level design outline guides DSR project planning and reporting (Baskerville et al., 2018). (refer to Tables 2.3 and 2.4). The rules also aid in evaluating an object. The next part addresses Drechsler and Hevner's high-level Design Research approach (2016).

This project used design science research technique to create a tool (cloud adoption framework) for SMEs in Zimbabwe to use to adopt cloud computing as a business strategy. Hevner (2007) introduced DSRM with three cycles: relevance, design, and rigour. Figure 2.2 depicts these cycles.

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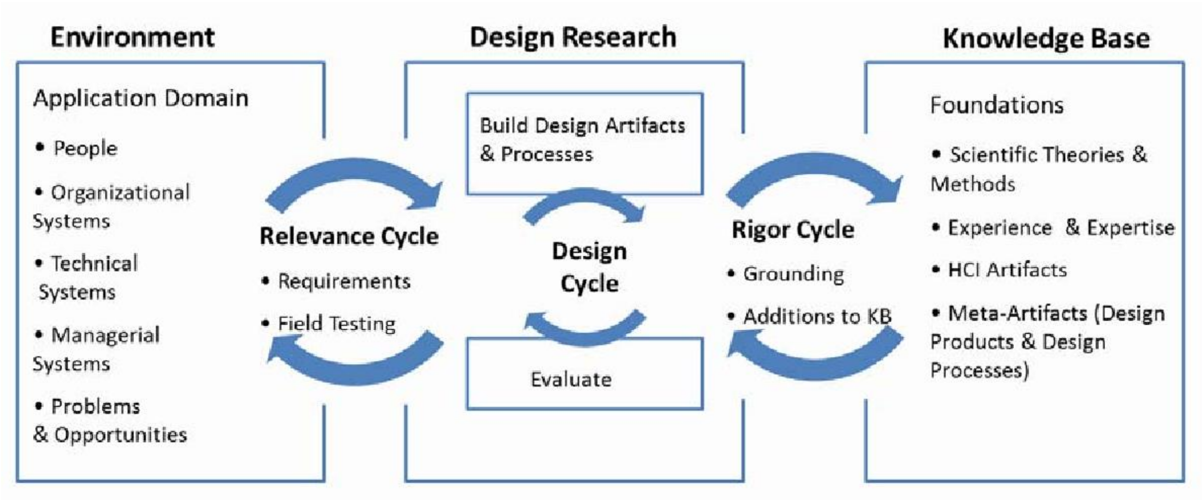

Figure 2-2: Three cycles of Design Science Research (Adapted from Henver (2007))

As seen in Figure 2.2, the relevance cycle establishes a connection between the research study environment and the design science research activities. The relevance cycle establishes the study's pertinent requirements (a framework for cloud computing adoption by SMEs in Zimbabwe) and the evaluation criteria for the study's findings.

The rigour cycle connects design science research activities to the knowledge base, which serves as the study's basis or reference base. It is a body of information that has been gathered over time and is relevant to the study subject (literature review).

The design cycle iterates continually between the relevance and rigour phases. This cycle is used to design, develop, and evaluate the artefact.

Drechsler and Hevner adapted Hevner's (2007) three-cycle design research model and added a fourth cycle (2016). The updated DSR now features four distinct cycles, making it truly unique. The change and impact cycle (CIC), the relevance cycle (RC), the design cycle (DC), and the rigour cycle are these cycles (RC). All of these cycles are relevant to this investigation and are depicted in Figure 2.3. Section 2.9 details the characteristics of the four-cycle approach to design science research.

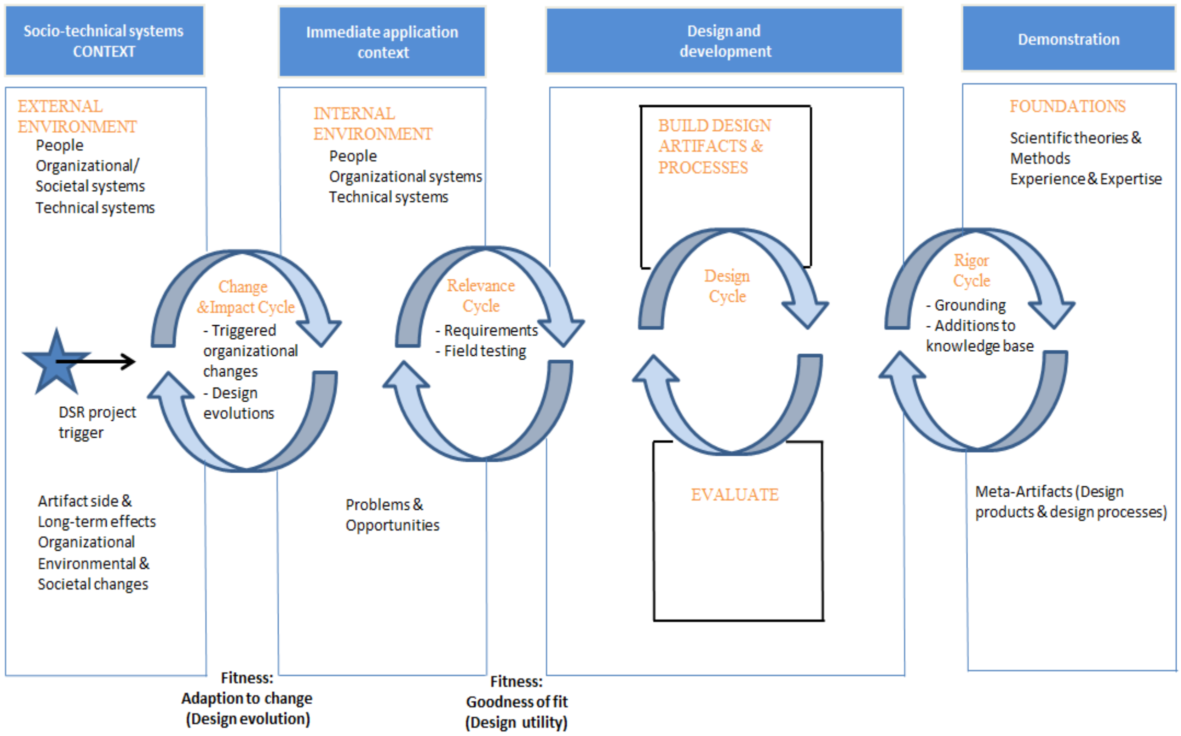

Figure 2-3: A four-cycle view of design science research Drechsler and Hevner (2016, p. 5).

2.9 THE FOUR-CYCLE VIEW OF DESIGN SCIENCE RESEARCH

As previously stated, Drechsler and Hevner (2016) added a fourth cycle to Hevner's (2007) three-cycle model of design science research, dubbed the change and impact cycle (CI). Throughout the four stages, the artefact's design and development are iterative. According to the four-cycle model, the introduction of an object into its local surroundings might result in changes to the larger environment. These changes may result in the emergence of new issues, which may alter the direction of the project. As discussed below, these shifts are to be expected in a dynamic and turbulent environment.

The following section details the stages of Drechsler and Hevner's four-cycle perspective of design science research (2016).

- **Change and Impact (CI).**

The CI cycle covers the application of the artefact to a broader environment. Projects are usually driven by environmental factors in which the artefact is to be used. CI provides a window for researchers to become aware of the dynamics in society and organisations and incorporate these dynamics to produce a satisfactory artefact. Society and organisations are continually changing, and these changes may trigger dissatisfaction in using an artefact. For example, some SMEs are not competitive in the global market because they are still using legacy systems. The use of these legacy systems can affect the artefact's viability and utility (legacy system). CI helps researchers be aware of such dynamics to prepare beforehand to counteract such challenges.

- **Relevance cycle**

It outlines the issues to be addressed in the form of opportunities, problems and requirements. Relevance acts as an interface between the environment and the artefact (Drechsler & Hevner, 2016). For this study, the identified problem is the unavailability of a suitable cloud computing adoption framework to guide SMEs in Zimbabwe to migrate to the cloud. Therefore, the research developed a cloud computing adoption framework to guide SMEs in Zimbabwe to migrate their legacy systems to the cloud. The framework is relevant to the SMEs in Zimbabwe to survive and be competitive in the global market.

- **Rigour cycle**

The rigour cycle proffers an existing knowledge base to the research project. It explains how the artefact is positioned in the extant knowledge base. The rigour cycle explains what works and what does not work evaluated based on the available knowledge base, relevant scientific theories, expertise and experiences. The selection of an appropriate knowledge base in the form of theories and methods is essential to ensure the development of an artefact that meets the users' expectations. MLR analysis was used to evaluate the artefact's goodness of fit, thus adding rigour to the research findings.

- **Design cycle**

It is the epicentre of the design science research project. It is where design, redesign and development of artefacts are carried out (Hevner, 2007). In this cycle, the artefact is evaluated, remoulded and refined until a satisfactory design is achieved.

It is essential to consider the immediate environment where the artefact will be used and the external wider environment to understand the artefact's opportunities and limitations (the generalisability of the artefact) (Drechsler & Hevner, 2016).

Unlike Hevner's three cycle view of science design which is time-consuming (Pirkkalainen, 2015), the four-cycle advocates for shorter iteration cycles (Drechsler & Hevner, 2016). The urgent needs of an organisation and the dynamic environment demand quick solutions. Therefore, short design cycles are preferred in a volatile environment to maintain the artefact's viability and utility (Drechsler & Hevner, 2016).

The model in Figure 2.3 is supported by seven guidelines for DSR as proposed by Hevner et al. (2004)and Niehaves (2007), as outlined in Table 2.3 below. The relevance of the guidelines for this study is explained in the table.

Table 2-3: Guidelines of Design Science Research (Niehaves, 2007).

Guideline	Description	Relevance to this research
Guideline 1: Design as an artefact	Design Science Research must produce a viable artefact in the form of a construct, model, method, or instantiation.	A cloud computing adoption framework will be developed to guide decision-makers in SMEs to adopt cloud computing.
Guideline 2: Problem relevance	The objective of Design Science Research is to develop technology-based solutions for important and relevant business problems.	The framework is aimed at helping SMEs to adopt cloud computing. It is also aimed at cloud service providers to tailor-make their products for different SMEs to increase cloud adoption and at the government to make policies that encourage cloud adoption in SMEs.
Guideline 3: Design evaluation	The utility, quality, and efficacy of a design the artefact must be demonstrated rigorously through well-executed evaluation methods.	Iterative evaluation that is ongoing from a qualitative evaluation of the artefact in Chapters 4 and 5 and lastly MLR analysis in Chapter 6 for the final evaluation of the artefact (also see Figure 2.5)
Guideline 4: Research contribution	Effective Design Science Research must provide transparent and verifiable contributions in the areas of the design artefact, design foundations and design methodologies.	The contribution of this study is, in terms of an artefact (cloud adoption framework), expected to be used by SMEs to increase cloud computing adoption. The artefact will also be useful to cloud service providers and the government of Zimbabwe to help them put proper infrastructure to help SMEs to adopt cloud computing (see Chapter 8).
Guideline 5: Research rigour	Design Science Research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.	The artefact will undergo different MLR assumptions tests before it goes through MLR analysis. (see Chapter 6).
Guideline 6: Design as a search process	The search for a practical artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.	An iterative process will be followed to develop, evaluate and refine the (cloud computing adoption framework) artefact, to solve the wicked problem of lack of cloud adoption framework.
Guideline 7: Communication of research	Design Science Research must be presented effectively to technology-and management-oriented audiences.	Research results will be communicated throughthe completed thesis and articles published in journals.

The Design Science Research Process, as proposed by Peffers et al. (2007), will be used as the reference for this study, as shown in Figure 2.4 and outlined in Section 2. The four-cycle view of design science research by Drechsler and Hevner (2016) as relates to this study is explained below.

2.10 APPLICATION OF DSR IN THIS STUDY

Table 2.4 shows the applicability of DSR to this study. The table includes the main features of the cycles in DSR and how they are related to this study. The cycles have been explained above.

The theories providing the theoretical foundation for this study are Diffusion of Innovation (DOI) and Technology Organisation Environment (TOE) (as discussed in Chapter 4, literature review on cloud computing). These theories explain factors that organisations should consider when migrating their legacy systems to the cloud.

Table 2-4: Design science research features.

	Hevner's three cycles of DSR (adapted from Hevner (2007))			**Four-cycle view of DSR: (adapted from Drechsler and Hevner (2016)).**
Cycle	Rigour Cycle	Design cycle	Relevance Cycle	Change and Impact Cycle
Main features of the cycle	Explains how the artefact design is grounded in the available knowledge bases, that is, expertise, scientific theories and experiences. The cycle shows what works and what does not work.	It supports the design/redesign and development of the actual artefact. Also, the artefact can be evaluated for viability and utility during the evaluation cycle. Evaluation can be carried out in the laboratory or real-world contexts or through simulations.	Defines: context problem opportunity requirements It acts as an interface between the environment and the artefact. The relevance cycle states the usefulness and acceptance criteria of the artefact.	This cycle is concerned with societal and environmental changes. It states the environment in which the artefact will be used, which includes people, Organisational systems and Technical systems. The cycle also advocates for short design cycles in a volatile environment to maintain the artefact's viability and utility.
Application in the study	Cloud computing adoption frameworks for SMEs: DOI (Rogers in 1962) and TOE (Tornatzky and Fleischer in 1990)	Integrating TOE and DOI. Develop a cloud adoption framework through the iterative cycles. Evaluation of the developed artefact will be carried out: expert evaluation will be sought.	The lack of cloud computing adoption frameworks in Zimbabwe necessitated this study. SMEs in Zimbabwe need contextualised cloud adoption frameworks to guide them to adopt cloud computing. It is an opportunity for them to penetrate the global markets.	People: managers, SME owners and promoters, customers. Organisational- SMEs, government, Cloud service providers. Societal and the country at large.

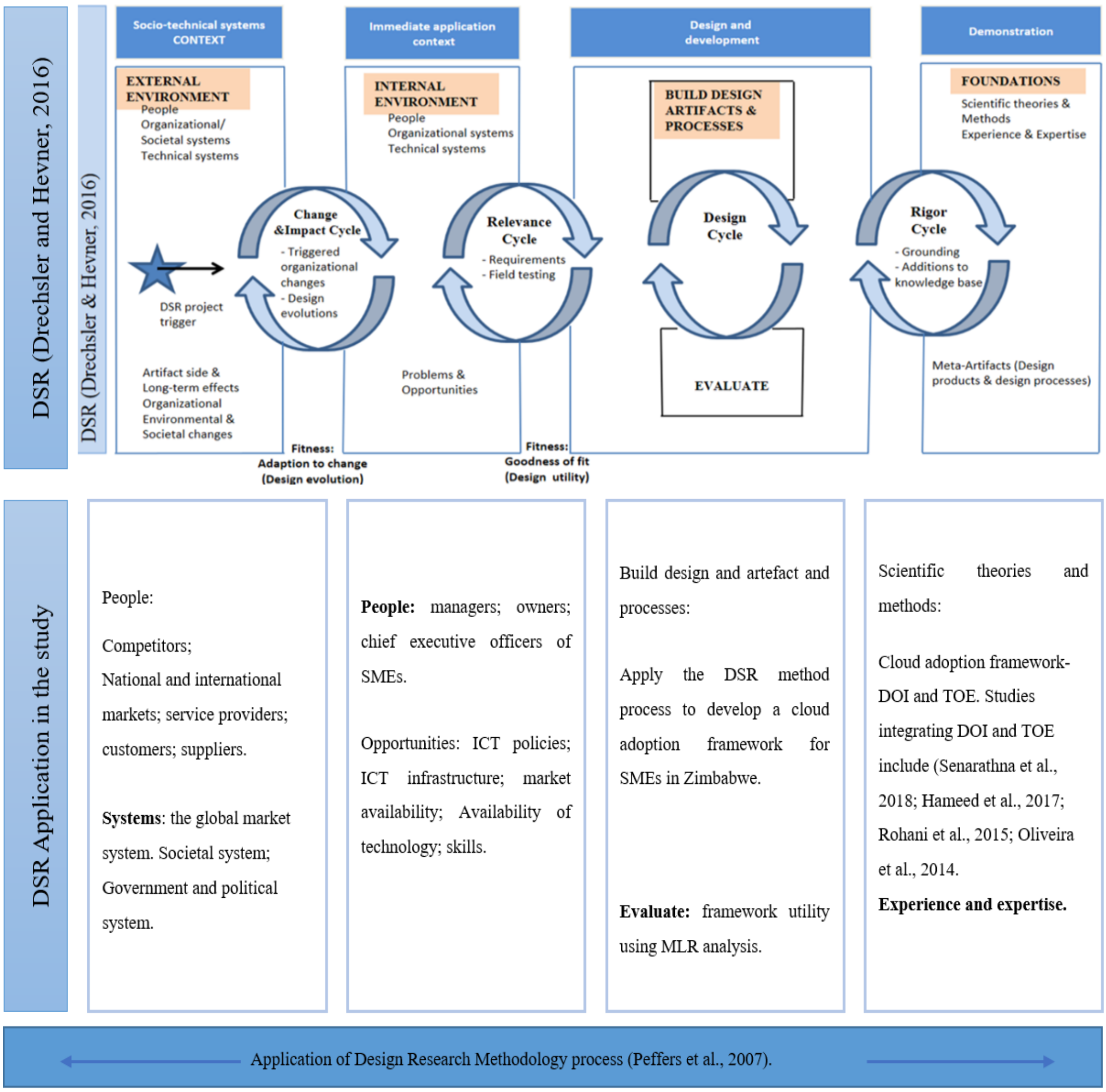

Figure 2-4: DSR - Application of DSRM in this research (Adapted from Drechsler and Hevner (2016)).

Design Research is cyclical in nature, allowing for extensive review and testing until the artefact or output fits the user's desired needs.

As mentioned in Sections 2.7.2 and 2.9, the proposed cloud computing adoption framework was developed using the design science research technique proposed by (Peffers et al., 2007). Only Drechsler and Hevner (2016)'s addition to the literature analysis offers principles that guide the constructor through four distinct phases of the artefact's development process to address an issue (Helms, Giovacchini, Teigland, & Kohler, 2010). Other prominent scholars remain silent on the constructor's role in the DSR technique (Hevner & Chatterjee, 2010;

Johannesson & Perjons, 2014; Oates, 2006; Peffers et al., 2007). The disadvantage of the DSR technique is that it is difficult to apply in areas where both the stated problem and solution are well understood (Thuan, Antunes, & Johnstone, 2016). The next section discusses how the DSRM process was used in this investigation.

2.9.1 Design Science Research Methodology (DSRM) process applied.

This section describes how the DSR methodology (Peffers et al., 2007) was applied in the study, as illustrated in Figure 2.5 below. Figure 2.5 provides a mental model of the activities and procedures involved in conducting IS research using DSR. According to Peffers et al. (2007), the DSR approach consists of six iterative phases. As indicated in Figure 2.5, these phases include identifying and motivating the problem, defining the solution's objectives, designing and developing the solution, demonstrating and evaluating the solution, and communicating the solution.

The next section covers the DSR technique processes used by Peffers et al. (2007) in this investigation. Peffers et al. (2007) describe six stages of the DSR approach (see figure 2.5).

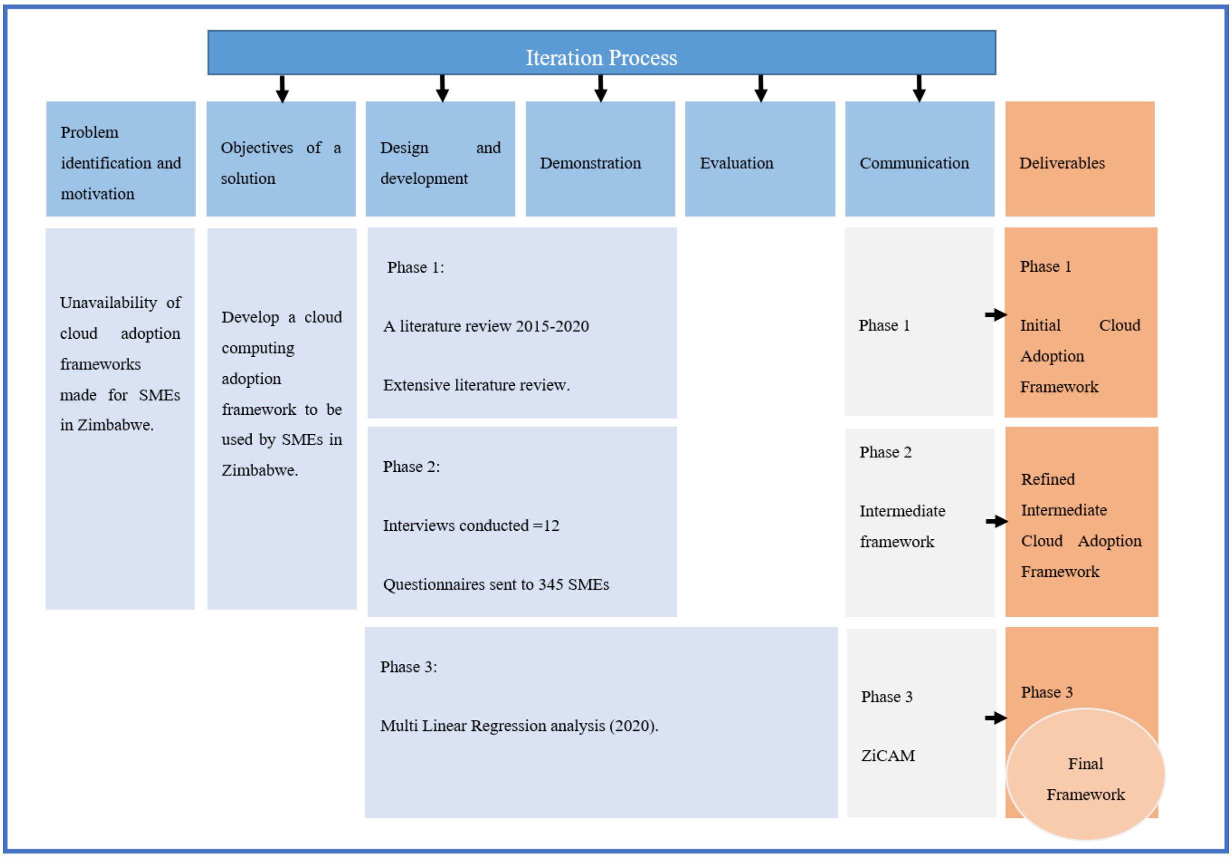

Figure 2-5: Application of DSR methodology process in this study.

- **Problem Identification and motivation.**

According to research, 85 percent of SMEs in Zimbabwe fail, 60 percent close during the first year, and around 25% close within the first three years of operation (Sachikonye and Sibanda, 2016), owing to a variety of issues confronting SMEs. One of the primary reasons businesses fail to thrive after a few years is a lack of competition on both the local and worldwide marketplaces (Harfoushi et al. 2016). To address this issue, SMEs in Zimbabwe should adopt new technology in order to remain competitive both locally and worldwide (Al-Hujran et al., 2018). According to research, cloud computing usage benefits SMEs by enabling them to improve their business processes (Amini & Bakri, 2015). Numerous studies have demonstrated numerous advantages for SMEs that utilize cloud computing as a business strategy and technology (Alkhalil et al., 2017; Amini & Bakri, 2015; Erind, 2015; Nguyen et al., 2015; Senarathna et al., 2018). Adopting cloud computing strengthens SMEs' competitive position; it enables them to access advanced IT resources without incurring significant capital expenditure, allowing them to focus on their core skills rather than reinventing the wheel (Al-Hujran et al., 2018). It is a well-known truth that industrialized and developing countries differ significantly in terms of economic development, but also cultural, political, environmental, and even social development (Rahayu & Day, 2015). As a result, it will be unjust to immediately apply study findings from a developed country to a developing country or vice versa.

According to some experts, there is no such thing as a one-size-fits-all technology adoption framework (Alkhalil et al., 2017; Chang & Barun Dasgupta, 2015), as each country has its own unique contextual environment. Additionally, some frameworks are excessively inflexible and may be unable to be customized to the unique characteristics of the SMEs' environment (Al-Hujran et al., 2018; Alkhalil et al., 2017). Additionally, the ever-changing technology landscape complicates the process of adopting a cloud computing framework built in a distinct environment (Palos-Sanchez, 2017). It is critical to understand the contexts in which SMEs operate in order to build a cloud computing architecture that is both user pleasant and reflective of the contexts in which SMEs operate.

The examination of the literature revealed a dearth of cloud adoption frameworks in Zimbabwe to assist SMEs in adopting cloud computing and becoming globally competitive. Thus, the scarcity of cloud adoption frameworks in Zimbabwe prompted this study to build a cloud computing adoption framework for usage by Zimbabwean SMEs.

- **Define the objectives of the solution.**

Once the problem had been identified, the next step was to formulate objectives for the study. This study's main objective was to develop a cloud adoption framework that would help SMEs in Zimbabwe migrate to the cloud. The DOI and TOE frameworks were used as the foundation of this study, as discussed in Chapters 3 and 4. Phases 1, 2 and 3 of the study gathered data through literature review, interviews, and questionnaires.

- **Design and Development.**

In this phase, the cloud adoption framework (artefact) was developed. The artefact's desired functionality and architecture were identified and tabled to guide the development process. Using TOE and DOI frameworks, the factors that affect cloud adoption of cloud computing by SMEs were identified. The data from interviews and questionnaires were used to identify the necessary constructs in the final artefact. The empathetic design was used to design and develop the intermediate model (Phase 2 artefact) instead of lateral design. Empathetic design is when the designer "tries to see the world through the eyes of project stakeholders" (Johannesson and Perjons, 2014). It is crucial so that the researcher sees what reality is in the eyes of the stakeholders. Phase 3 used an analytical design employing multilinear regression (MLR) analysis to develop the final artefact.

- **o Demonstration.**

This phase explains how the artefact is used. Both descriptive and explanatory knowledge are included in the demonstration. Explanatory knowledge explains how the artefact works, while descriptive knowledge tells how the artefact functions (Johannesson & Perjons, 2014). Explanatory information was employed to demonstrate why the artefact works. The model illustrates the quality of fit once the various variables meet the MLR assumptions.

- **o Evaluation.**

The evaluation phase determines whether or not the artefact is capable of resolving the stated problem or meeting the specified requirements (Johannesson & Perjons, 2014). According to Johannesson and Perjons (2014, p. 98), the evaluation's objective is to "assess whether the artefact is effective at resolving the problem for which it was presented." The artefact can be analyzed and tested quantitatively or qualitatively. Venable et al. (2016) provide a framework for FEDS evaluation. They advocate evaluating an artefact either ex-ante (before to the artefact's construction) or ex-post (after artefact construction). In this study, the object was appraised (ex-ante) prior to its fabrication. Ex-ante evaluation is a simple procedure that does not require a great deal of time or access to consumers or organizations (Johannesson & Perjons, 2014; Venable et al., 2016). The study evaluated the artefact using a quantitative analytical technique called MLR analysis. MLR analysis is used to determine the statistical significance and magnitudes of coefficients for various variables (see Section 2.15 and Chapter 6 for more evaluation of the artefact).Communication.

The artefact should be presented to practitioners and researchers (Johannesson & Perjons, 2014) and to the intended users, who are the SME owners and promoters. Communication is a basic form of evaluation in which the artefact is evaluated for vigour by other researchers to make it a knowledge base for future work. Also, the novelty and utility of the artefact should be communicated to and evaluated by experts. Thus, for this study, the communication will be in the form of a completed thesis and published journal articles to create a progressive, cumulative repository of knowledge to be used in the future.

During the above phases of development, implementation and evaluation, many iterative processes are carried out to tweak and fine-tune the artefact to the initial requirements, a process called "circumscription" (Vaishnavi et al., 2019). Repetitive processes may result from new ideas gleaned from the whole process of development, implementation and evaluation.

2.10 CONTRIBUTIONS OF THE DESIGN SCIENCE RESEARCH

Design Science Research contributes in several ways to the research. The contributions can be in the form of the new artefact, improvement of an old solution to solve new problems, routine design and exaptation. These contributions are explained below.

(Gregor & Hevner, 2013) designed a four-quadrant square to show the contribution of design science research. The four-quadrant square is shown below, and the subsequent explanation for each quad ensues.

The figure below highlights the main contribution of this study.

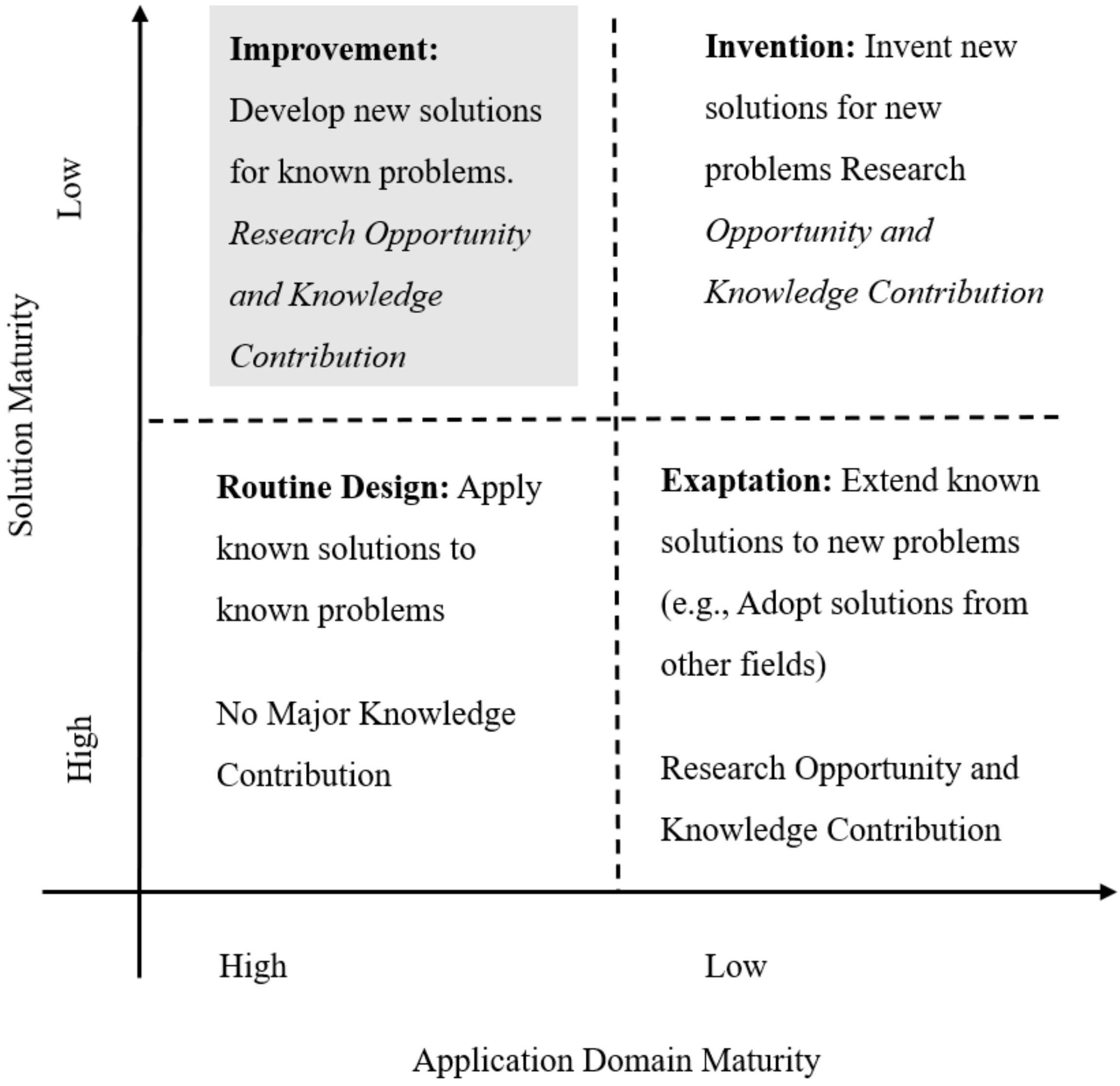

Figure 2-6: The DSR Knowledge contribution framework (This research is situated in the highlighted quadrant) (Adapted from Gregor and Hevner (2013)).

Gregor and Hevner (2013) argue that design science research's contributions can be positioned along with two dimensions of application domain maturity. The X-axis represents the Application Maturity domain and has two categories; the well-established (scientific theories) and the emergent (low). The Solution Maturity is on the Y-axis, and it is divided into High and Low Solution Maturity. The Low Solution Maturity has two quadrants; the Improvement and the Invention. The High Solution Maturity is also made up of two quadrants; the Routine Design and the Exaptation. The following section describes the four quadrants shown in Figure 2.6.

2.10.1 **Invention (New solutions for the problem)**

This is a case of radical innovation, in which a novel solution to a novel problem is proposed (Johannesson & Perjons, 2014). The solution demonstrates a complete break with conventional thinking and behaviour (Gregor & Hevner, 2013).

2.10.2 **Improvement (New solution for known problems)**

This work addresses well-known issues by proposing a novel and improved approach (Johannesson & Perjons, 2014). The term "improvement" refers to the process of enhancing existing qualities such as efficiency, usability, maintainability, and safety, as well as the addition of new critical characteristics (Gregor & Hevner, 2013; Johannesson & Perjons, 2014). Due to globalisation, SMEs must embrace ICT in order to remain competitive. SME's that rely on outdated systems struggle to remain competitive on a local and global scale. This research asserts that cloud computing usage improves current business practices and boosts the innovativeness and competitiveness of small and medium-sized enterprises (SMEs) in Zimbabwe.

2.10.3 **Exaption (Known solutions extended to solve new problems)**

This contribution repurposes an existing artefact to address a new challenge. A pre-existing solution to a certain problem is altered to address a situation for which it was never designed (Gregor & Hevner, 2013; Johannesson & Perjons, 2014). Exaptation frequently occurs in Biology and Information Science. For instance, in Biology, feathers on birds were originally designed to keep them warm but were eventually expanded to enable birds to fly (Gregor & Hevner, 2013). In information systems, the CATCH data warehouse for health care information has been extended to new virtual worlds to provide users with novel experiences that are notably different from those available online (Gregor & Hevner, 2013). (Known solutions for known problems)

This contribution solves a well-known issue by incrementally improving the present solution (Johannesson and Perjons, 2014). This occurs, according to Gregor and Hevner (2013, p. 347), when "existing knowledge for the problem area is well known, and an existing artefact is employed to address the problem."

DSR contributes to the corpus of knowledge in the following ways with this research:

• The research contributes to the body of knowledge on cloud adoption frameworks that assist decision-makers in SMEs in migrating their IT legacy systems to the cloud on a theoretical level.

On a methodological level, the framework establishes a framework that guides decision-makers through a step-by-step process, assisting them in making cloud migration decisions. The method emphasizes critical factors that serve as a checklist for cloud computing implementers as they examine their systems and determine whether they are prepared to migrate to the cloud.

• On a practical level, the framework is designed to assist SMEs in Zimbabwe in migrating their legacy systems to the cloud. The framework should assist SMEs in improving their business practices. The framework should educate SME owners, government officials, and other stakeholders about the importance of creating an enabling environment for SME migration to the cloud. Cloud service providers will also benefit from a better awareness of SMEs' requirements and expectations, allowing them to tailor their products to the specific needs of different SMEs.

2.11 DATA COLLECTION

Data collecting is a vital part of the research process and is always incorporated in some form in all research endeavours. It instructs a researcher on the proper collection and analysis of data (Johannesson & Perjons, 2014). The methodologies used to gather data in any research are determined by the research questions to be investigated, the research objective, and the sort of artefact to be generated (Saunders et al., 2012). To address the research issue, this study employed both qualitative (literature reviews and semi-structured interviews) and quantitative (descriptive and inferential statistics) methodologies. The two strategies are discussed in detail below.

2.11.1 Qualitative Data Collection Method

It is a method that collects data that is conveyed through text (Saunders et al., 2012). The main objective of this method relates to the deep meaning of the data. According to Terre Blanche et al. (2006), the qualitative method's focus is to study and understand people in their natural environment and tap on their feeling through their actions. It allows the researcher to personally hear, observe or even live through the existence of the participants of the study (Hevner & Chatterjee, 2010). This research used interviews and observation (literature review) as qualitative methods to collect data from SMEs. The following section explains more about different qualitative data collecting instruments that can be used in research.

2.11.1.1 *Interviews*

Johannesson and Perjons (2014, p. 157), define an interview as direct communication between a researcher and a respondent "in which the researcher controls the agenda by asking questions to the respondent." Interviews can be structured, unstructured or even semi-structured, depending on what the researcher is looking for.

- **Semi-structured interviews**

In this type of interview, there is a framework with some interview questions that guide the researcher. The questions can be modified to elicit more information from the participant (Peters & Halcomb, 2015; Rodgers, Hosseini, Chileshe, & Rameezdeen, 2015). Modifying the questions is essential to allow participants to openly share their feelings, experiences and emotions during the conversation.

- **Structured interviews**

It is an interview that consists of a pre-planned set of identical questions to be answered by every participant (Creswell & Poth, 2016; Rodgers et al., 2015).

- **Unstructured interviews**

The issue under discussion is made known to the participants, and the interviewer can ask any question related to the issue under discussion. This type of interview generates rich data from the participants because they can air their minds about the issue under discussion without much intervention from the interviewer (Rodgers et al., 2015). The interviewer can ask follow-up questions and some probes to elicit as much information as is possible from the participants (Peters & Halcomb, 2015).

Advantages of interviews include interviews illicit complex and sensitive information from respondents and that during the interview, interviewers and respondents are allowed to rephrase their questions and responses respectively, to increase understanding, thus making interviews flexible (Babbie & Mouton, 2012; Johannesson & Perjons, 2014; Oates, 2006). In this study, the interview helped the researcher get insight into organisational practices, technological resources, and issues pertaining to the environment in which the SMEs understudy operate.

Due to resource restrictions (limited time), this research collected data from the owners, managers, or CEOs of the sampled SMEs via telephonic semi-structured interviews. The interview questions were categorized into topics gathered from the DOI and TOE frameworks for technological adoption to guide the interview process and discourse and to facilitate data analysis.

An interview procedure was employed to guide the interview's flow (Appendix C). The interviews were taped (with permission) using a digital voice recorder in order to accurately capture all interview data.

As indicated previously, the interview questions were drawn from the DOI and TOE cloud adoption frameworks. The survey questions focused on the technological, organizational, and environmental aspects that influence SME cloud computing adoption. Each interview was performed via telephone in order to elicit unique perspectives from each participant and lasted approximately 25 to 30 minutes. Twelve interviews with SME owners, managers, and CEOs were conducted. Participants were given an opportunity at the conclusion of each interview session to add comments or ask questions about the study. All interview sessions were audiotaped, and participants were advised that audio recordings were preferable due to their ability to allow reliable data mining and analysis. To ensure accuracy, all audio recordings were listened to many times and transcribed. To avoid bias and to validate the interview data, the audiotapes were replayed and compared to the transcribed notes. We evaluated the transcribed notes and generated a summary sheet for each interview. The summary sheets were then examined for trends and correlations (Al-Hujran et al., 2018; Miles & Huberman, 1994).

2.11.1.2 *Observations*

Marshall and Ross (2010) note that observation as a data collection instrument allows the researcher to understand the context in which SMEs operate. It allows the researcher to cross-check inconsistencies and distortions in the data obtained during the interviews. During observations, one tries to understand how often something happens and not why something happens (Saunders et al., 2012). It also helps to understand relations between different departments in the whole SME. Another advantage of observation is that systems are observed in their natural environments, and "data are collected as they occur in their natural settings" (Saunders et al., 2012).

It is also important to note that if the interviews are conducted on participants' premises, the researcher can understand contextual issues about technology use and relations in their organisations. Field notes on how some operations are carried in SMEs can be noted to support data obtained from the questionnaires and interviews.

2.11.1.3 *Documents Analysis*

Existing documents of an organisation can give insights into the type of technology used, trade pursued by an organisation, roles, and workflows. Documents analysis gives insights into some problematic aspects of using other data-generating instruments (Braun & Clarke, 2013).

Documents reviewed can include policy and strategic documents, company memos, email communications, roles and responsibilities, functions of different departments, minutes of meetings and newspaper articles (when available). Reviewed documents may be used to validate some responses to the questionnaires and interviews. However, owing to the sensitive nature of the information contained in some of the documents, some SMEs may be reluctant to avail the documents.

2.11.1.4 *Expert Reviews*

Experts reviews are essential to review the research products or outcomes (Jansen & Hak, 2005; Richey & Klein). Expert reviews should be sought to provide credible assessment and determine whether the research outcome is relevant to the research problem (Richey & Klein). Holbrook, Krosnick, Moore, and Tourangeau (2007) advise that the number of experts to be consulted should be between two and five. These experts should be familiar with and knowledgeable about the subject under discussion to offer a credible assessment. In this study, two experts with a vast knowledge of developing and implementing cloud computing frameworks were consulted.

2.11.1.5 *Literature Review*

According to Mullarkey and Hevner (2019) and Hofstee (2006), a literature review situates the study's theoretical foundation and validates its relevance to the body of knowledge. The literature review helps to identify the current knowledge gap in the area of study. It helps evaluate and understand other researchers' views on the topic under study (Iyawa, Herselman,

& Botha, 2017). In DSR, rigour demands that a researcher draw from the existing knowledge base (literature) accumulated in the IS domain to understand the issues inherent in IS (Mullarkey & Hevner, 2019).

In this research literature review was used in the first phase of the study. There are two chapters of the literature review. Chapter 3 reviewed literature on SMEs' importance to a developing country like Zimbabwe, and Chapter 4 gathered information on cloud adoption frameworks. Literature review helped to develop an initial cloud computing framework for SMEs in Zimbabwe. The following section highlights quantitative data collection methods.

2.11.2 **Quantitative Data Collection Method**

Collects and aggregates data in the form of numbers or at least data that can be changed into numbers and statistically analysed (Saunders et al., 2012). According to Oates (2006), survey-based research and experiments are good examples of quantitative methods. For this study, an online questionnaire was used as the applicable quantitative data collecting technique.

2.11.2.1 *Questionnaire*

A questionnaire is a written document that has a series of questions that are delivered to multiple respondents in order for them to respond and provide data to a researcher (Johannesson & Perjons, 2014; Oates, 2006). Participants' demographic data and information regarding their attitudes, knowledge, and beliefs about cloud computing adoption in their SMEs were collected via questionnaires. The researchers presented the goal of the study and the questionnaire to the participants. The questionnaire employed a 5-point Likert scale. According to (Joshi, Kale, Chandel, & Pal, 2015), a Likert scale is a psychometric response scale that is used in questionnaires to elicit respondents' preferences or degree of agreement with a posed statement or collection of assertions. The five-point Likert scale employed in this study varied from "strongly disagree" with an ordinal value of 1 to "strongly agree" with an ordinal value of 5, with "disagree," "neutral," and "agree" in between.

During Phase 3 of this investigation, the questionnaire was employed. The questionnaire was distributed to decision-makers at SMEs to elicit their perspectives on the issues affecting their organizations' cloud adoption. The questionnaire relied heavily on closed-ended questions in order to elicit precise replies that are straightforward to code and analyze statistically (Babbie & Mouton, 2012). Only four open-ended items were included in the questionnaire due to their length and the possible effect on the questionnaire's completion rate.

For this study, the web-based questionnaire was distributed to 345 SMEs owners, managers and CEOs in Harare and Bulawayo. A cover page explaining the purpose of the study and assuring and guarantying confidentiality accompanied the questionnaires. The questionnaire was developed from the DOI and TOE cloud computing adoption frameworks based on results from Phase 2 of the study. The questionnaire had two sections, Section 1 collected demographic information, while Section 2 collected information based on factors affecting cloud computing adoption (technological, organisational and environmental factors).

The questionnaire was adopted from empirically tested instruments that have been used in many different studies(Saunders, Lewis, & Thornhill, 2009). This step was taken to avoid problems of validity and reliability of the measurements. The questionnaire for this study was adopted from Ali, Soar and Shrestha. (2018) and Alkhater, Walters and Wills (2018). The following table shows Cronbach's Alpha values of the questionnaire items to prove reliability.

Table 2-5: Questionnaire Reliability Measurements.

Construct /Factor	Cronbach's Alpha	Number of items
Technological Factors		
Relative advantage	0.813	4
Compatibility	0.709	4
Security	0.760	9
Complexity	0.702	5
Cost	0.840	6
Trialability		5
Organisational Factors		
Top Management Support (TMS)	0.809	4
Size of Organisation (SO)	0.770	5
Technological Readiness (TR)	0.942	4
IT Knowledge of Employees (IKE)	0.754	4
Environmental Factors		
Government Regulation	0.836	7
Competitive Pressure	0.763	4
Information Intensity	0.711	4
External Support	0.883	5
Cloud Adoption	0.885	4

One of the recommended properties of a good questionnaire is an excellent layout to increase the response rate. M. N. K. Saunders and Tosey (2012) recommend that a well-designed questionnaire be precise and have unbiased titles for different parts in the questionnaire and easy to read and complete. Some studies have provided some general guidelines to be used when designing a questionnaire, and the following guidelines are adapted from (Oakshott, 2012):

- Use simple words and avoid jargon.

- Avoid questions with two parts that ask more than one question (double-barrelled questions).
- Keep questions short
- Ask simple questions that can be answered quickly.
- Use natural logic to order the questions to answer step by step.

All the above recommendations were factored in during the designing of the questionnaire for this study. Mainly closed-ended questions were included in the questionnaire to make it easy to answer, thus increasing the response rate. The closed-ended questions are quick to respond and easy to code and analyse. All hyperactive and less articulate respondents are given a fair chance to complete the questionnaire successfully.

Some advantages of a questionnaire are that they generate large amounts of data at a low cost both in materials and time; the same type of questions are sent out to many respondents simultaneously, thus increasing reliability and reducing bias found in interviews (Oates, 2006). The questionnaire was distributed as an online survey to the sampled SMEs. This approach was used to allow all the SMEs to access the questionnaire easily and consequently improve the response rate. The questionnaire used is shown in Appendix B.

2.12 DATA ANALYSIS

Yin (2014, p. 132) defines data analysis as "the process of examining, categorizing, tabulating, testing, or otherwise recombining evidence to produce empirically based findings." In plain English, this means that once the data collection phase of research is complete, the next phase is to analyze and interpret the data in order to decipher the meaning of the findings. Numerous strategies are available for data analysis, and the technique that is used is determined by the type of data obtained and the reason for which the data were acquired. Data analysis approaches can be characterized as qualitative or quantitative. Separate analyses of qualitative and quantitative data were conducted. Thematic analysis, hermeneutic analysis, and content analysis were utilized to analyze qualitative data in this study. This study used statistical analysis to conduct quantitative analysis; the first section was descriptive analysis, followed by inferential statistics. These strategies are detailed in greater detail below.

2.12.1 **Analysis of Qualitative Data**

Qualitative data analysis necessitates that the researcher grasps the data (Creswell & Poth, 2016). The following strategies were utilized to conduct a qualitative analysis of the data in this study.

2.13.1.1 *Thematic Analysis*

It is a technique for recognizing, analyzing, and reporting on patterns (themes) included inside data (Yin, 2014). Thematic analysis is a technique used in qualitative research to convert qualitative data to qualitative knowledge (Braun & Clarke, 2013). This method is critical for properly interpreting and interpreting data in a more understandable manner. The interview data is then categorized according to a given theme. Data with a common theme are grouped together.

The data from the interviews (see Chapter 5) were categorized into distinct themes to facilitate analysis. The themes were generated from the DOI and TOE frameworks for cloud adoption presented in Chapter 4 of this research. Prior to doing the analysis, several topics were identified. The following topics were identified for this study:

Table 2-5: Interview Themes.

Category	Theme
Technological Factors	Reliability of cloud computing
	Relative Advantage
	Compatibility
	Security Issues
	Complexity
	Cost Savings
	Trialability
	Uncertainty
	Trust
	Observability
Organisational Factors	Top Management Support
	Size of Organisation
	IT knowledge of employee
	Technological Readiness
	Innovativeness of the firm
	Age of firm
Environmental factors	Government regulations
	Competitive pressure
	Information Intensity
	External support
	Trading Partner Pressure
	Market scope
	Industry

2.12.1.1 *Hermeneutic Analysis*

Vieira and De Queiroz (2017) define hermeneutic analysis as the art of interpreting a text in a circular movement involving both subjective and objective sides, which is in line with the pragmatism research paradigm used for this research. Brannick and Coghlan (2007) reckon that hermeneutic considers social reality by interpreting social actors' meanings as the key themes from which theory will be built.

The hermeneutic analysis takes into account three things which are: statements (expression), interpretation (explication) and translation (interpretation) (Vieira & De Queiroz, 2017). This means that hermeneutic analysis deals with text and, to no small extent, with the lifeworld phenomenon (with people and human products) (Vieira & De Queiroz, 2017).

In this study, the hermeneutic analysis was used to analyse data from the interviews and text from the literature review, presented in Chapter 5.

2.12.1.2 *Content Analysis*

Bengtsson (2016) defines content analysis as a technique used to understand the contents of data analysed. It is used to organise and (elicit) distil meaning from the collected data and draw credible and realistic conclusions. The researcher is at liberty to a manifest analysis or a latent analysis, or both (Vieira & De Queiroz, 2017). A manifest analysis means the literal meaning of data, while latent analysis digs down to get the hidden meaning of data (Bengtsson, 2016). Content analysis requires the researcher to focus on selected aspects of meaning (Vieira & De Queiroz, 2017) related to the research question. In this research, content analysis was used in Chapters 3 and 4 to review literature until the themes were identified. It was also used in Chapter 5 to analyse the semi-interview data.

2.12.2 **Quantitative Data Analysis**

Descriptive and inference statistics can be used to analyze quantitative data. Descriptive statistics are used to mathematically describe and compare variables (Saunders et al., 2012). It describes data using tables, central tendency (mean), or dispersion (Rdestad et al., 2013; Saunders et al., 2009).

SPSS software was used to analyze the quantitative data acquired in this study via a web-based survey questionnaire (version 26). The quantitative data analysis was carried out in stages, using descriptive statistics as the first step. Descriptive statistics were employed to analyze the demographic data in order to have a better understanding of the survey respondents' demographic and behavioural characteristics. The second step was to conduct a series of tests, the first of which was a sampling adequacy test (to determine whether the sample size was sufficient for the study) using the Kaiser-Meyer-Olkin (KMO) statistic, followed by the Bartlett test for sphericity and Exploratory Factor Analysis (EFA). Finally, the link between the dependent variable (cloud computing adoption framework) and the independent variables was predicted using multilinear regression (MLR) analysis. Chapter 6 covered MLR analysis in further detail.

The following section discusses triangulation in relation to this investigation.

2.13 TRIANGULATION

Saunders et al. (2009) define triangulation as "the use of different data collection techniques within one study to ensure that the data are telling you what you think they are telling you." Triangulation improves the credibility of results, as supported by Yin (2014, 2015), who submits that triangulation helps establish consistency across evidence collected from different sources. Rodgers et al. (2015) posit that triangulation ensures that rigour, reliability, validity and sound quality are achieved during data collection procedures.

Triangulation between different data sources helped identify factors affecting cloud computing adoption, which will refine the already conceptualised framework from the literature review. This research used the following forms of triangulation:

- Theoretical triangulation is when a study draws on two or more theoretical frameworks. This study is based on DOI and TOE theoretical frameworks.
- Methodological Triangulation: means that the study uses two or more methods to collect data. The use of different methods helps balance each other's weaknesses and leads to greater confidence in the researcher's conclusions(Saunders et al., 2009). This study used literature reviews (Chapters 3 and 4), interviews, questionnaires, observations, expert reviews and document analysis to collect data.
- Analysis Triangulation: is using two or more techniques to analyse data. This study used thematic analysis, hermeneutic analysis, descriptive statistics and content analysis.
- Data Triangulation: means collecting the same data from different sources. This study used primary data sources (questionnaires, interviews, observations and expert reviews) and secondary data sources (literature review and document analysis).

2.14 POPULATION AND SAMPLING

Population refers to all the elements with specific common characteristics (Hair Jr, Hult, Ringle, & Sarstedt, 2016). The sample of SMEs for this study was drawn from two major cities Harare and Bulawayo, the industrial hubs in Zimbabwe. Thus, the unit of analysis for this study is the SME sector in both Harare and Bulawayo. The sampling frame was extracted from an SME directory obtained from the offices of the SME Association of Zimbabwe (SMEA-ZW) located in Bulawayo. Only owners, managers, CEOs and promoters of SMEs with some knowledge on leveraging IT in their business in general and cloud computing adoption were used in this study.

2.14.1 **Sampling and Sample Size**

This study utilised purposive sampling and cluster sampling techniques. According to Teddlie and Yu (2007, p. 77), purposive sampling allows the researcher to intentionally "select units (individuals, groups of individuals, institutions) based on specific purposes associated with answering the research study's question." Purposive sampling aims to identify a few individuals with the required knowledge or experiences on the topic being researched (Johannesson & Perjons, 2014). The purposive sampling technique was used during the qualitative stage of data gathering, while cluster sampling was used during the quantitative stage of data gathering. SMEs were randomly selected from the SMEA-ZW directory. However, the element of randomness was reduced by using non-probability convenience sampling to elicit data from the participants, and the results can be generalised for SMEs in other cities in Zimbabwe that were not part of the study. The section below explains the sample sizes used for both qualitative and quantitative stages for this study.

2.14.2 **Qualitative Sample Size**

Qualitative research scholars argue that there is no agreement on how many study units constitute the right size of a sample in qualitative studies (Olivier, 2017; Vasileiou, Barnett, Thorpe, & Young, 2018). Some qualitative research experts recommend that a qualitative research sample should be large enough to allow for the extraction of "new and richly textured understanding of the phenomenon under study, but small enough so that there is deep case-oriented analysis" (Green & Thorogood, 2018; Olivier, 2017; Vasileiou et al., 2018).

Other qualitative researchers have proffered numerical recommendations based on experts' experiences in qualitative research. Green and Thorogood (2018) and Vasileiou et al. (2018)

suggest that in interviews, little new information will be generated after interviewing twenty people, while Ritchie, Lewis, Nicholls, and Ormston (2013) recommend no more than fifty individuals should be interviewed in research. Hence according to Vasileiou et al. (2018, p. 2), be able to "manage the complexity of the analytic task." However, others like Onwuegbuzie and Collins (2007) recommend using the same sample for qualitative and quantitative data gathering. They refer to identical sample relationships, which is appropriate for mixed methods research.

Lincoln and Guba (1990) suggest that sample size is determined by informational redundancy, that is, sampling can be terminated when there is information saturation when no new information is elicited from the sample (Vasileiou et al., 2018).

The sample size for the qualitative phase in this study was selected based on the age of the SME, type of industry the SME is engaged in and use technology in their business processes, as shown in Table 2.5 below. Based on the above discussions and the selection criteria, twelve SMEs were purposively sampled for this study. Purposive sampling was used to select a few participants with vast knowledge related to the research question. A sample of twelve SMEs was considered large enough to understand the contextual factors that affect cloud adoption in different organisations. Based on (Tirgari, 2012) recommendations, an average of ten participants is enough for a researcher to encounter thematic saturation. For this study, twelve SMEs were considered large enough to experience thematic saturation. Table 2.6 shows profiles of SMEs that participated in the interviews.

Table 2.6: Profile of SMEs that participated in the interviews.

SME ID	Sector	Role	Number of years in existence
SME01	Textile and Clothing	Owner	3
SME02	Construction	Owner	2
SME03	Farming	Manager	5
SME04	Textile and Clothing	Manager	7
SME05	Textile and Clothing	Owner	4
SME06	Grocery/ Food processing	Owner	3
SME07	Chemical/ Electrical products	Manager	2
SME08	Manufacturing	Manager	6
SME09	Carpentry and Wood carving	Owner	4
SME10	Finance	Manager	3
SME11	Transport	Manager	3
SME12	IT	Owner	3

Sample sizes in qualitative studies are usually much smaller than in quantitative studies (Dworkin, 2012). During interviews, the researcher may use observations and document analysis to get more information (Dworkin, 2012; Yin, 2014). Thus, the use of multiple sources of evidence is rated more highly in terms of quality than the use of one single source (Yin, 2014). Thus, the use of multiple sources

2.14.3 **Quantitative sample size**

According to the Zimbabwe Ministry of Finance and Economic Development, Zimbabwe has over 3 000 000 SMEs, of which only 15% are officially registered with various organizations. For example, 71% of registered SMEs are registered with local councils, 17% with the registrar of companies, between 4% and 6% with the registrar of cooperatives such as SMEAZ, and 7% are registered elsewhere, such as RBZ-MFI (Matunhu, 2020). There are roughly 18 500 SMEs registered with SMEA-ZW in Harare and Bulawayo (Kazunga, 2019). These SMEs operate in a variety of fields, as illustrated in Table 2.7 below. The sample for this study was taken from a diverse sectorial spectrum of SMEs in Harare and Bulawayo. Table 2-7: Sectoral Distribution of SMEs registered with SMEA-ZW.

Sector	Percentage (%)
Agriculture / farming	43
Wholesale and Retail	33
Manufacturing	9
Energy and Construction	3
Art and Entertainment	2
Transport	1
Mining and Quarrying	1
Tourism	1
Other Services	7

Source: Hansard Parliament of Zimbabwe 2017.

SMEs in Zimbabwe are found in geographical clusters in local administrative areas called Economic Zones. These economic zones are found in each major city in Zimbabwe. Each economic zone is made of SMEs that specialise in different types of trade. As already mentioned in Section 2.15 above, cluster sampling was used during the quantitative data collection stage. According to Saunders et al. (2016), choosing research samples from a few relatively compact geographical areas (clusters) maximises the amount of data a researcher can collect because the participants exist in proximity.

Thus, due to limited resources (time and funding), the study samples for this study were drawn from SME clusters in Harare and Bulawayo. The quantitative stage's purpose was to produce results that would be generalised to all SMEs in the two cities, Harare and Bulawayo in Zimbabwe. The two cities were used because here, where the most SMEs are found. The samples used for the qualitative stage were different from those used in the quantitative stage. It is also important to note that although the two data collection methods were given equal attention in terms of time allocation and amount of depth in data collection, this research is inclined more towards a quantitative method approach for the sole purpose of generalising the results of this research.

Unlike qualitative research, where no sample size is agreed upon, quantitative research contains criteria for sample size selection and the application of various statistical processes. The sample size is determined by the sort of statistical analysis to be performed on the data. Delice (2010) states that the sample size is determined by the number of independent variables in the investigation. Table 2.8 summarizes the rules for computing sample sizes in quantitative research, taken from VanVoorhis and Morgan (2007).

Table 2-8: Rules for sample size (Source: VanVoorhis and Morgan (2007)).

Relationship	Reasonable sample size
Measuring group differences (t-test, ANOVA)	The cell size of 30 for 80% power should not be smaller than 7% if it is decreased.
Relationships (correlations, regression)	50 and above
Chi-square	At least 20 overall, no cell smaller than 5
Factor Analysis	300 is good

As a general rule, Table 2.8 indicates that a sample size of fifty or more individuals is required to analyze associations (correlation and regression) (Delice, 2010; VanVoorhis & Morgan, 2007). A sample size of twenty or more participants is required for the Chi-square test, whereas 300 participants are required for factor analysis. The sample size of 345 participants was deemed acceptable for this study based on VanVoorhis and Morgan's (2007) guideline in the preceding table and the number of independent variables.

2.15 EVALUATION OF ARTEFACT

This study developed a cloud adoption paradigm using the DSR approach. DSR was chosen for this study because it emphasizes the development and creation of constructs, models (frameworks), methods, and instantiations (Herselman & Botha, 2015). It is critical to demonstrate thoroughly that the artefact works during the DSR assessment process by providing additional development feedback (Venable et al., 2016). Herselman and Botha (2015) describe evaluation as the process of determining the value or significance of a DSR artefact. According to Herselman and Botha (2015), any assessment method, plan, or activity should emphasize what needs to be assessed, when it should be reviewed, and how it will be evaluated.

However, research indicates that there is little guidance on how to evaluate DRS artefacts and that the evaluation methods described in the literature are fragmented and ambiguous (Iyawa, Herselman, & Botha, 2019), as they do not specify which method to use for particular criteria (Prat, Comyn-Wattiau, & Akoka, 2014). The researcher is left bewildered as to which assessment method to utilize, why, when, and how to use it (Venable et al., 2016). Thus, the researcher may be free to choose the context in which the object will be utilized and the approach that best suits the artefact's nature (Iyawa et al., 2019).

Numerous studies have presented evaluation methodologies and procedures for DSR artefacts (Elragal & Haddara, 2019; Herselman & Botha, 2015; Hevner et al., 2004; Prat et al., 2014; Venable et al., 2016). However, according to some researchers (Prat et al., 2014), the evaluation criteria offered in the literature are either fragmented or incomplete. Additionally, each artefact has unique characteristics and meanings, necessitating the use of distinct evaluation procedures (Herselman & Botha, 2015).

Contributing to the field of artefact evaluation methods, (Prat et al., 2014) suggest a general evaluation method in which an artefact is considered as a system that should be evaluated using a variety of approaches at various stages of development. Venable et al. (2016) provide a framework for FEDS evaluation. They advocate evaluating an artefact either ex-ante (before the artefact's construction) or ex-post (after the artefact's production) (after artefact construction). Hevner et al. (2004) define five distinct evaluation techniques: observational, analytical, experimental, and testing. Venable, Pries-Heje, and Baskerville (2012) offer a framework for selecting DSR assessment methods, as seen in Table 2.9 below. A researcher must select the quadrant in the table that best describes the artefact.

Table 2-9: DSR Evaluation methods Selection Framework (Adapted from Venable et al. (2016)).

DSR Evaluation Method Selection Framework	Ex Ante	Ex Post
Naturalistic	Action Research Focus Group	Action Research Case Study Focus Group Participant Observation Ethnography Phenomenology Survey (qualitative or qualitative)
Artificial	Mathematical (analytical) or Logical Proof Criteria-Based Evaluation Lab Experiment Computer Simulation	Mathematical or logical Proof Lab Experiment Role-Playing Simulation Computer Simulation Field Experiment

Naturalistic evaluation examines how an artefact works in its natural setting, whereas artificial evaluation examines how an artefact performs in a controlled environment, such as a laboratory, in order to verify or refute the artefact hypothesis (Venable et al., 2012, 2016). Ex-ante or ex-post evaluations of the item are possible. Johannesson and Perjons (2014) emphasize the contrast between ex-ante and ex-post litigation (Section 2.10.1). They define ex-ante evaluation as the process of evaluating an artefact before its use or even completion, whereas ex-post assessment requires the artefact to be used.

In this investigation, the artefact was appraised artificially and ex-ante. The ex-ante evaluation was chosen because it is a quick procedure that does not demand much time or access to consumers or organizations (Johannesson & Perjons, 2014; Venable et al., 2016). A mathematical method was used to examine the artefact conceptually. The mathematical tool is analogous to Hevner et al.'s analytical evaluation method (2004). This method was chosen in accordance with Herselman and Botha's (2015) guideline that any method chosen must rigorously examine the artefact. According to Gregor and Hevner (2013), a rigorous design artefact evaluation employs methodologies such as analytics (mathematics), case studies, and simulations. As a result of these observations, and as indicated in the highlighted section of the table above, this study was evaluated using a mathematical (analytical) technique.

The artefact was evaluated using MLR analysis (ZiCAM). MLR is an analytical tool for determining the statistical significance and magnitude of coefficients (Wilson et al., 2015). MLR was employed as a statistical approach to predicting with sufficient precision the independent variables affecting cloud adoption by SMEs in Zimbabwe.

MLR analysis examines and evaluates the fitness of variables to the model through the use of assumptions. To determine the model variables' fitness, the following assumptions were tested: sample size, multicollinearity, normality test, homoscedasticity, and outlier testing. However, before verifying for assumptions, the model's statistical significance (the F-value) must be determined.

After satisfying all of the assumptions, the next step was to determine the structural model's goodness of fit by calculating the R-squared value from the Anova table (Khayer, Talukder, Bao, & Hossain, 2020). The R-squared value indicates the path coefficient's coefficient of determination and its level of significance (Hair Jr et al., 2016; Khayer et al., 2020). In other words, R-squared quantifies the explanatory power of comparing the percentage variances of independent and dependent variables (Khayer et al., 2020; S. J. Yang et al., 2018).

R-squared has a value between zero (0) and one (1). (Hair Jr et al., 2016). If R-squared is near to 1, it indicates that the model fits the data the best (Hair Jr et al., 2016; Khayer et al., 2020; Pallant 2020). According to S. J. Yang et al. (2018), a large R-squared value suggests that the model has strong explanatory power. Additionally, it is critical to emphasize that the model becomes effective in practice when all of the model's assumptions are met.

One notable downside of utilizing MLR analysis as an evaluation technique is that it considers variables to be significant only if they have a linear connection with the dependent variable and considers nonlinear variables to be inconsequential regardless of their importance. In such instances, the model's generalizability is called into question. However, high sample size can be employed to compensate for MLR analysis's shortcomings.

The finished thesis, journal papers, and other scholarly publications will be used to communicate and disseminate study results. The research used MLR analysis to evaluate the artefact (ZiCAM). MLR is an analytical tool that examines the statistical significances and coefficients' magnitude (Wilson et al., 2015). As a statistical tool, MLR was used to predict with power the independent variables affecting cloud adoption by SMEs in Zimbabwe.

MLR analysis uses assumptions to examine and evaluate the fitness of variables to the model. The following assumptions were tested to evaluate the fitness of the model variables: sample size, multicollinearity, normality test, homoscedasticity and testing for outliers. However, before checking for assumptions, the model's significance (the F-value) must be checked first for statistical significance.

2.16 ETHICAL CONSIDERATIONS

In research, ethics refers to the practice of doing what is ethical and permissible (Oates, 2006). This research adheres to UNISA's (2007) research ethics policy, and the researcher considered the following ethical issues over the course of the study:

- Permission in writing: UNISA provided permission for the research to be conducted (see Appendix A).
- Informed consent and voluntary participation: Participants were informed about the purpose of the research, that participation was optional, and that they were allowed to withdraw from the study at any time they felt uncomfortable. Participants were required to sign a permission form indicating that they were freely participating in the study.
- Confidentiality and privacy: The confidentiality of participants was maintained throughout the data collection procedure, as the study did not divulge the identities of individuals or SMEs.

2.17 CONCLUSION

This chapter describes the research methodology of this study. Different philosophical paradigms were discussed, and pragmatic presented as the research paradigm for this research. Pragmatism works well with studies that adopt DSR as a research methodology, and for that and many more reasons, DSR was chosen as the methodology for this study. The chapter presented both qualitative and quantitative data collection methods in different phases of the research. The data collecting instruments used are questionnaires, interviews, and literature reviews. The qualitative data collected will be analysed using thematic analysis, hermeneutic analysis, content analysis, while quantitative data will be analysed using descriptive and inferential statistical analysis. The chapter also highlighted methods that will be used to evaluate the artefact. Also highlighted was triangulation techniques as well as ethical considerations. The next chapter will present a literature review on SMEs' importance to developing countries in general and Zimbabwe in particular.

CHAPTER 3 LITERATURE REVIEW ON SMES AND CLOUD COMPUTING

3.1 INTRODUCTION

The preceding chapter presented research methodology. The Design Science Research (DSR) (Drechsler & Hevner, 2016) was chosen to develop a cloud adoption framework for SMEs in Zimbabwe. This chapter is the first of the two literature review chapters for this study. The chapter sets in context the theoretical foundation for this study by presenting a literature review on Small Medium Enterprises (SMEs), cloud computing and its benefit to SMEs, challenges faced by SMEs in adopting the cloud computing technology. Many research papers were used during this literature review to understand the importance of SMEs to a country.

The following section discusses the importance of the literature review. It spells out the strategies used to find the relevant literature, the databases used, and the criteria used to exclude some literature.

3.2 IMPORTANCE OF LITERATURE REVIEW

A literature review is an "important research method in itself" (Boell & Cecez-Kecmanovic, 2014, p. 260). Literature review in research provides an insight into the research problem. It provides a theoretical foundation (Kumar, Samalia, & Verma, 2017) to develop a cloud adoption framework to help SMEs in Zimbabwe adopt cloud computing. Reviewing literature helps the researcher identify the research gaps and clearly define the research problem (Kumar et al., 2017).

The literature review discussed in chapters 3 and 4 presents an exploratory phase of this study, providing relevant concepts, theories and evidence about developing a cloud computing adoption framework. Chapter 3 discusses SMEs, their roles and challenges they face in adopting emerging technologies. Chapter 4 discusses cloud computing and adoption models. The literature review in chapter 4 also notes the complexity of the adoption of cloud computing by SMEs. The advantages and disadvantages of the adoption models or frameworks are also discussed in chapter 4. Because each model has advantages and disadvantages, the literature review recommends that two or more frameworks be integrated to address the other's shortcomings (Chiu, Chen, & Chen, 2017). In this study, DOI and TOE frameworks were combined to produce a preliminary cloud adoption framework.

Literature review helped to understand the challenges faced by SMEs in Zimbabwe. Furthermore, the literature review helped to answer the research questions of this study. Thus, the literature review attempts to answer these sub-research questions:

Chapter 3: SRQ1: Why is there a need, and what are the needs for SMEs to migrate their legacy systems to the cloud?

Chapter 4:

SRQ 2: What current cloud computing adoption frameworks exist that support strategic

decision-making, and what are their shortcomings?

SRQ 3: What are the main tasks and steps that SMEs should perform when making the strategic choice to adopt cloud computing as an ICT solution?

3.2.1 **Search strategy**

A literature review should help and find as many related studies to the research topic as possible. Keywords that fall within the research objectives were identified. The Boolean operators OR and AND were used to link the keywords.

3.2.2 **Sources used**

Harzing's Publish or Perish software was used for the preliminary keyword search. The software retrieves important, relevant publications related to the topic under study. Besides Harzing's Publish or Perish, some scholarly sources were used. These sources include journals, policy documents, books, web pages and dissertations. The sources were derived from academic databases such as IEEE Xplore, ACM, SAGE Premier, EBSCOhost, Science Direct, ProQuest, Emerald, Google Scholar, IGI global, Scopus and in some cases, from Newspapers. The literature review is conducted throughout the research from 2017 to 2020.

3.2.3 **Keywords used**

Keywords used are aligned with the research topic: developing a framework for adopting cloud computing by small-medium enterprises in Zimbabwe. The keywords are:

- SMEs AND "cloud systems"
- SMEs AND "cloud systems" AND "migration"
- SMEs AND "cloud computing"

- SMEs AND “cloud computing” AND “migration”
- SMEs AND “cloud computing” AND “developing countries”
- SMEs AND “cloud computing” AND “migration” AND “developing countries”
- SMEs AND “cloud computing in Zimbabwe”
- SMEs AND “cloud computing adoption challenges”

3.2.4 Inclusion

Conditions for selecting the relevant scholarly sources from the database search were that the source's publication date should be written in English. There were some exceptions to the criteria.

3.2.5 Exceptions

- Some relevant textbooks which fell outside the criteria were considered
- Recommended publications by experienced researchers were also considered.
- Published theories or adoption frameworks which fell outside the five-year criteria were also considered.
- Reverse referencing was considered if it fell outside the criteria.

3.2.6 Exclusion criteria

Exclusion criteria were mainly based on examining the topics, abstracts and publication date. Sources irrelevant to the research questions were not considered. Sources from rogue and pirate publishers were not considered.

3.2.7 Analysis of the selected sources

A total of 1604 sources were retrieved from both Harzing's Publish or Perish software and academic databases. A total of 430 duplicates were removed and excluded from the research. The remaining 11174 publications were screened, and a total of 421 were removed based on the exclusion criteria. A total of 753 full-text articles were assessed, and 262 articles were excluded. A total of 491 publications were included because they met the inclusion criteria of this study. Figure 3.1 shows the process used in the selection of the articles.

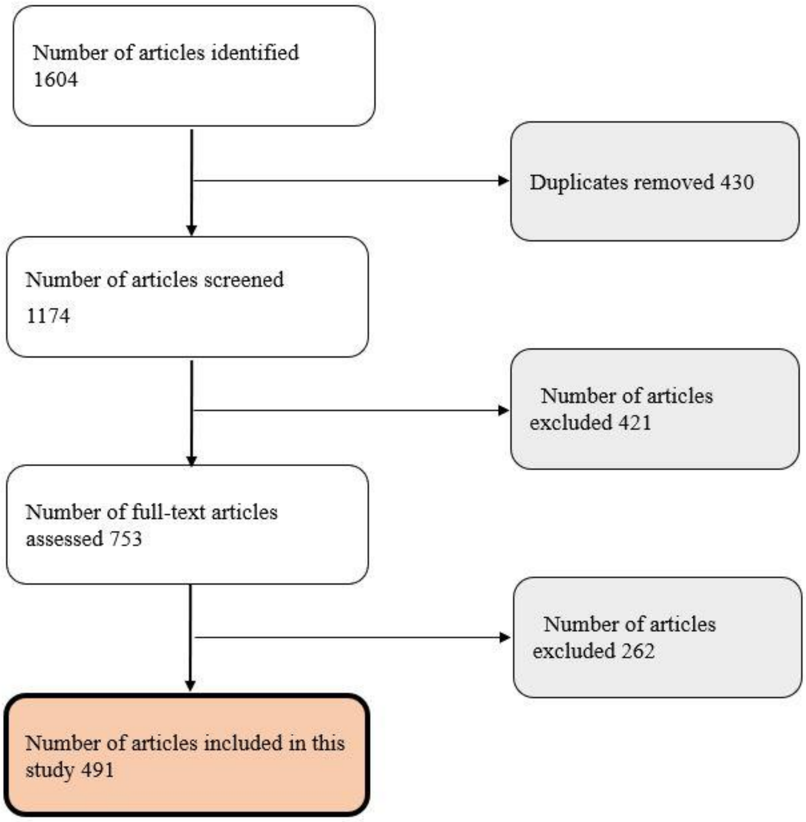

Figure 3-1: Searches of publications in literature review towards developing a framework for the adoption of cloud computing by small-medium enterprises in Zimbabwe.

The following section defines and outlines some general characteristics of SMEs in Zimbabwe and the world.

3.3 Definition and Characteristics of SME

Research shows that there are many different definitions of SMEs (Karadağ, 2016; Muriithi, 2017). A study conducted in 75 countries found more than 75 different definitions of SMEs used in the target countries (Muriithi, 2017). It means that there is no universally accepted definition of an SME because countries are at different levels of economic development and perceive what SME differs from country to country (Bayramov et al., 2017; Karadağ, 2016). However, there are standard parameters in an SME definition, including annual turnover, the number of employees, asset base and sometimes management style (Karadağ, 2016; Oduntan, 2014).

In Turkey, SME is defined as a registered company with up to 100 employees and with a maximum turnover of US$830 000 (Bayramov et al., 2017). In South Africa, an SME, according to Ayandibu and Houghton (2017), is an enterprise that has fewer than 250 employees and a turnover of less than R40m. The Nigerian SME is defined as any enterprise with a maximum asset base of N200 million excluding land and working capital and with several staffs employed not less than ten or more than 300 (Effiom & Edet, 2018; Oduntan, 2014). The above definitions have the number of employees as their common denominator. In the Malaysian context, an SME definition is based on the number of full-time employees or the annual sales turnover and industry categories of SMEs in Malaysia. The Malaysian definition brings in a new dimension of full-time employees. Other definitions are silent on the nature of employees.

No harmonised definition of SME in Zimbabwe could be found in the literature. Different organisations and arms of government have different definitions of SME to suit their corner. The Ministry of SMEs in Zimbabwe defines an SME as an organisation that hires not more than 50 employees, while a medium enterprise is one hiring 75 to 100 employees (Nyathi, Nyoni, Nyoni, & Bonga, 2018). The definition highlights the differences between small and medium enterprises. The Small Enterprise Development Cooperation (SEDCO)(2020) which is an arm of government, defines an SME as an entity that has less than 100 employees with maximum annual sales revenue of US$830 000 (Nyathi et al., 2018). The revenue collecting authority of Zimbabwe, the Zimbabwe Revenue Authority (ZIMRA)(2016) defines an SME differently. According to ZIMRA (2016), an SME is defined according to the points scored based on turnover level, total asset values and number of employees, as shown in Table 3.1 below:

Table 3-1: ZIMRA's point conversion table (Source: ZIMRA (2016)).

Base	Range	Points	Factor
Number of employees	Up to 5 employees	1	A
	6 to 40 employees	2	
	41 to 75 employees	3	
	76 and above	4	
Annual turnover	Up to $50,000	1	B
	$50,001 to 500,000	2	
	$500,001 to $1,000,000	3	
	$1,000,001 and above	4	
The gross value of assets	Up to $50,000	1	C
	$50,001 to $1,000,000	2	
	$1,000,001 to $2,000,000	3	
	$2,000,001 and above	4	

According to the ZIMRA (2016) definition, any enterprise with a score less than seven (7) qualifies as an SME. The total scores obtained by adding factors A, B and C will determine whether an enterprise is an SME or not. This research adopts the ZIMRA definition of SMEs.

The availability of many definitions and the SME sector's diverse nature make it very difficult to support the sector. The challenge is compounded by the fact that even in one country like Zimbabwe, SME definitions multiply. There is no clarity on the meaning of an SME. Karadağ (2016) argues that an SME definition is not fixed; it is continuously revised with the changing macroeconomic environment. When the macroeconomic environment improves, the definition of an SME also changes to suit the prevailing environment. It means the policies put in place to support SMEs have to change, making it challenging to analyse and support this sector. The diverse nature of this sector makes it even more challenging to understand how it can be supported. Challenges faced by SMEs are discussed under Section 3.5. The next two sections discuss SMEs' characteristics and the Role of SMEs in a country, respectively.

The SME sector is very diverse in terms of business operations from mining, agriculture, service sector, among many different SMEs (Muriithi, 2017). Albeit the diversity, there are fundamental characteristics that are common to all SMEs. One of the most important characteristics is that SMEs are dynamic, nimbler and eager to venture into the murky waters than big enterprises (Ayandibu & Houghton, 2017). It means that by their nature of being small, they are more innovative, very flexible and quick to respond to any changes in the market (Bayramov et al., 2017; Karadağ, 2016). For example, SMEs can adapt and respond very quickly to customer needs.

Generally, SMEs are family-managed businesses, and in most cases, they are very flexible in decision-making (Ayandibu & Houghton, 2017). The chain of communication within an enterprise is short and fast; hence decisions are made quickly. The decision-making process is informal, and therefore there are no bureaucratic board meetings that can delay business opportunities. According to Ayandibu and Houghton (2017), SMEs usually have a narrow range of products. The will to expand the business depends on the personal drive of the owner of the enterprise.

3.4 CHALLENGES FACED BY SMES IN ZIMBABWE.

The first notable challenge is the lack of one standard definition for the SME sector. The definition of an SME has been fraught with the problem of definitional clarity (Muriithi, 2017). There is a need to have one standard definition to avoid confusion among entities that deal with SMEs. For example, in Zimbabwe, the SMEs sector has its own definition that suits its own criteria; the revenue collecting entity (ZIMRA) has its own definition. In contrast, the government has a different meaning of an SME. As a result, there is no synergy among these entities, and there will be discord in crafting policies that help SMEs grow.

SMEs' other challenge in Zimbabwe is the lack of managerial skills and training by owners and promoters (Majoni et al., 2016; Mugozhi & Hlabiso, 2017; Nyathi et al., 2018; Tinarwo, 2016). As a result, SMEs lack an appropriately skilled labour force for the needs of the local job market (Bayramov et al., 2017). Although Zimbabwe is well known for its high literacy rate, it still lacks business acumen and skills to sustainably run its businesses (Bayramov et al., 2017; Karadağ, 2016; Sachikonye & Sibanda, 2016). Majoni et al. (2016) note that the owners and promoters of SMEs lack business strategy, inability to separate business and personal finances, and the inability to employ qualified personnel.

On business finances, Chimucheka and Mandipaka (2015) posit that SMEs in Zimbabwe raise capital through personal savings, friends and family members. SMEs resort to that method of raising business capital because they cannot access funds from banks and other lenders because they do not have enough collateral security deposits to hedge against the borrowed funds.

Lack of finance hampers the long term growth and competitiveness of SMEs (Mugozhi & Hlabiso, 2017). According to Sachikonye and Sibanda (2016), access to finance is a significant challenge for Zimbabwe's SMEs' growth. Lack of access to finance is not unique to SMEs in Zimbabwe but is also experienced by SMEs in other countries. A recent study in OECD countries shows that lack of finance is a significant challenge for SMEs, especially start-ups (Karadağ, 2016; OECD/ERIA, 2018). A survey carried out on SMEs by the World Bank for a period of ten years (2005 to 2015) covering 119 countries concludes that access of finance is one of the most critical challenges that hinder the growth and development of SMEs (Muriithi, 2017; Ndiaye, Razak, Nagayev, & Ng, 2018; Wang, 2016).

Lack of financial literacy among owners of SMEs is another huddle that must be surmounted. After getting expensive business loans from a financial institution, some managers and SME owners spend finances on buying expensive cars and all other luxuries at the expense of the core business (Ayandibu & Houghton, 2017). Financially illiterate owners of SMEs may continue to struggle to source funds because they lack knowledge and understanding of available financial services. The World Bank (2018) aptly notes that Zimbabwe lacks a coordinated and well-oiled financial literacy strategy.

Banks in Zimbabwe seem to lack an understanding of more subtle details of the requirements of SMEs. The banks still use rigid regulations which force SMEs to bend to their needs, which in other words, should be the opposite (Sachikonye & Sibanda, 2016). The banks should tailor-make products that suit the requirements of SMEs. However, this is a big challenge to the banks because of many SMEs and diverse trade lines, and it is challenging for the banks to cater to the needs of each SME sector.

A survey by the World Bank concludes that Africa's financial systems are costly, shallow, small and can only reach a small population of SMEs (Muriithi, 2017). The conclusion aptly describes the situation in Zimbabwe. Borrowing money from banks is very expensive in Zimbabwe. Another research by Wang (2016) indicates that the high interest rate is a severe constraint that prevents SMEs to borrow money from banks and other financial institutions. According to The Herald Newspaper (2018), before 2015, banks charged 35% interest per annum on loans advanced to SMEs. From 1 October 2015, banks agreed to reduce interest rates to 18% and were further slashed to between 6% and 12 % as of May 2018 (The Herald Newspaper, 2018). The interest rates are still high, even if there was a significant cut. To compound the challenge, banks require collateral in the form of immovable assets from even start-up SMEs (Sachikonye & Sibanda, 2016).

According to Muriithi (2017) mortality rate of SMEs in Africa is unacceptably high, with five out of seven new SMEs fail within their first year of establishment. In South Africa, 75% of SMEs do not mature to become established SMEs (Muriithi, 2017). This trend seems to be experienced across the whole African continent. SMEs in Zimbabwe are not immune to the challenges faced by other SMEs across the African continent. They face serious viability challenges and end up closing within a short time. In South Africa, it is estimated that about 40% of SMEs fail in their first year of existence, while 60% in the second year and 90% with the first ten years from inception (Bushe, 2019) due to a plethora of challenges faced by SMEs. It is a sad situation, and hence banks and other financial lending institutions view SMEs as high-risk enterprises.

Zimbabwean financial sector has been in dire straits for the past decade (Sachikonye & Sibanda, 2016). The financial sector experienced periods of hyperinflation and collapsing of the local currency, closure of banks (Nyathi et al., 2018; Sachikonye & Sibanda, 2016), and some banks were put under judiciary management. The closure of some banks caused the shrinking of the financial sector, and as a result, borrowing funds from banks is very expensive (Mugozhi & Hlabiso, 2017; Sachikonye & Sibanda, 2016). The liquidity crunch hamstrung the ability of banks to support SMEs.

Zimbabwe is ranked at 159 out of 191 countries globally in terms of doing business environment index (Bayramov et al., 2017; Schwab, 2018). It shows that the ease of doing business environment is still very tight. For example, a country with a lower index; for example, 4 means that it has simple and friendlier regulations to start a business. Therefore, there is a need to improve regulations and the business environment to promote the proliferation of SMEs.

Corruption negatively affects the operations of SMEs. According to Transparency International (2017), Africa has some of the world's most corrupt nations. Corruption forces SMEs to divert some of their hard-earned money to bribe unscrupulous officials to award them with tenders or ward off constant harassment and intimidation (Transparency International, 2017). It means that SMEs have to cut their budgets to pay for unscrupulous and unethical activities, consequently reducing the business performance (Muriithi, 2017). According to the World Bank (2018), about 24.8% of Sub-Saharan Africa firms are expected to pay a bribe to get an operating permit or license. Corruption significantly reduces government revenue and will come down to haunt SMEs because the government will not be able to deliver the necessary services to help and promote the growth of SMEs.

The use of low technology by SMEs in Turkey limits their growth, both endogenously and exogenously (Karadağ, 2016). Majoni et al. (2016) concur with Tinarwo (2016) on some SMEs' challenges in Zimbabwe. They agree that there is low technology usage, and hence becomes challenging for SMEs to be competitive globally. Technology, therefore, improves the visibility of SMEs both on the local and global markets.

Research carried out on SMEs in Africa shows that instead of expanding, there are more closures and only 1% of SMEs grow from five or fewer employees to ten or more (Ayandibu & Houghton, 2017; Muriithi, 2017). The reason for SMEs' failure is consistent with the theory of technological capabilities by Lal and Bharadwaj (2016) in Tinarwo (2016). According to the theory, SMEs fail because they lack the financial clout to use both as working capital and investing in technology, which helps them be competitive on the global market (Tinarwo, 2016). Kabanda and Brown (2017) observe that SMEs in Africa is still lagging in IT usage because "they have not yet reached the institutionalisation phase of having full interactive, transactive or integrated IT capacity." The digital divide is one reason why there is this disparity in the effective use of technology by SMEs in developing countries. The following section discusses the term digital divide; ICT infrastructure and Zimbabwe's ICT regulatory framework hinder SMEs from adopting ICT. The unavailability of the right infrastructure is a big challenge to developing countries like Zimbabwe, which dramatically affects SMEs' survival.

3.4.1 The Digital Divide

Budiono et al. (2018) suggest that the digital divide slows down the rate of IT adoption in developing countries. According to Scheerder, van Deursen, and van Dijk (2017), the digital divide is the gap that exists between those that can access digital transformation through the Internet and those that cannot. Simply put, the digital divide means unequal access to information between nations, gender, or socio-economic groups within a nation. The term digital divide has metamorphosed over time from "a focus on binary Internet access (first-level digital divide) and Internet skills and use (second-level digital divide) to a third-level digital divide in which the tangible outcomes of Internet use are highlighted" (Scheerder et al., 2017, p. 1607). The term digital divide has shifted from quantitatively looking at how many can access the Internet to the qualitative use of that access to the Internet.

A more encompassing and broader definition of digital divide comes from B. Zhang, Jin, and Peng (2018, p. 5) who define it as, "the gap between individuals, households, business and geographic areas at different socio-economic levels with regard both to their opportunities to access ICT and to their use of the Internet for a wide variety of activities." This definition tries to incorporate all three levels of the digital divide mentioned above.

Most SMEs in developing countries are still at the first level of the digital divide, and they lack real Internet access, skill and hence do not effectively use IT to be competitive on the global market (Budiono et al., 2018; Fuchs & Horak, 2008). The digital divide can limit SMEs from adopting emerging technologies. In Indonesia, the rural population is about 55.9% but only accounts for 11.1% of online shopping in the whole country (Budiono et al., 2018). In Zimbabwe, the rural population is 67.72%, but only 23.12% of the population has access to the

Internet (Zimbabwe Democracy Institute, 2018). SMEs that do not have access to the Internet have reduced opportunities to compete with those that already have access. Technology adoption promotes the digital economy in a country, which facilitates quick access to information in real-time to make quick, informed decisions (INSEAD, 2016). Research shows that utilising appropriate ICTs comes with a leapfrog effect in socio-economic development (Sebina & Mazebe II, 2014). In the developed world, 21% of economic growth is attributed to access to quality internet and other appropriate ICTs (Sebina & Mazebe II, 2014). It means that access to quality Internet access can improve social inclusion in the digital market. Some studies show that narrowing the digital divide would lead to quality, social mobility and economic growth (Hargittai, 2010; Silverstone, 2017). Widening the digital divide would mean that some individuals and organisations continue to be economically excluded because they cannot access correct and accurate information at the right time to make informed decisions (Obinkyereh, 2017). Results from another study show that the digital divide is proportional to the level of economic development of a nation, the higher a country's economic development, the narrower the digital divide (Khaemba, Muketha, & Matoke, 2017).

Previous studies show that most countries in the developing world are well endowed with natural resources. Furthermore, for that reason, they are lethargic to deploy ICTs in different socio-politic-economic spheres, unlike those countries with limited natural resources that are aggressive to implement ICTs to remain economically viable and competitive (Obinkyereh, 2017; Pradhan et al., 2016; Sebina & Mazebe II, 2014). The Asian Tigers countries like Korea have limited natural resources and have compensated for this lack by developing a high ICT penetration nationwide and now boasts of one of the world’s best Internet penetration rate (Pradhan et al., 2016; Sebina & Mazebe II, 2014). In developing countries and indeed, there are more immediately pressing issues in Zimbabwe that need to be prioritised and addressed. Issues like food shortages, clean water, shelter, electricity and medical care (AfDB, 2019). This assertion seems paradoxical because research shows that the adoption of technology improves how to do things, thereby addressing developing countries' concerns (Bukht & Heeks, 2017; Niebel, 2018; Pradhan et al., 2016). However, ICT infrastructure is still a significant challenge in many developing countries. The following section briefly examines the state of ICT infrastructure in Zimbabwe.

3.4.2 **Gender and SMEs**

Adoption and use of ICT have been seen to establish a new inclusive social order in any society (Mohanty et al., 2020). The United Nations identified ICT as a tool to advance gender equality (Musungwini et al., 2020) in societies across the world. Despite the availability of advanced ICTs, a study by the European Parliament's Committee on Women's Rights and Gender Equality in 2018 shows the existence of a huge gender digital divide regarding the access and use of ICTs with low participation of women in the digital market (European Parliament's Committee on Women's Rights and Gender Equality, 2018).

Women worldwide experience discrimination in my facets of their lives, but this discrimination is more conspicuous in developing countries than developed countries (Mohanty et al., 2020). In developing countries, women have fewer rights than men (Ragasa and Sengupta, 2014). In addition, women face cultural biases and stereotypes deeply rooted in many patriarchal societies, especially in developing countries (Mohanty et al., 2020). For example, in some countries like the Democratic Republic of Congo, women need their husband's consent to start a business (Ragasa and Sengupta, 2014).

According to Mohanty et al., (2020), women in developing countries face many challenges that include limited access to education opportunities and lower access to ICTs to improve their businesses. Women start to experience gender bias at an early age which impacts their learning and educational pathways (OECD, 2019), consequently limiting the number of females studying sciences and technical subjects (Ragasa and Sengupta, 2014) in schools and colleges. Lower education opportunities limit women's access to ICTs, affecting their technical understanding of adopting and using ICTs in their SMEs. Studies by the World Bank and IFPRI (2009) and Tiwari (2010) show that lack of knowledge and skills to access and use ICTs are barriers to adopting innovation.

To bridge the gender divide regarding adoption and use of ICTs by women's SMEs requires formulation of effective and women targeted policies by governments and all stakeholders. According to Mohanty et al., (2020), this can be achieved by increasing women's participation during the policymaking process. Women know their needs and can articulate them clearly if they are well represented in the decision-making processes.

Training helps to spread digital literacy skills, which help empower women and develop technical skills to build confidence in the adoption and use of ICTs in their SMEs (Mohanty et al., 2020). Empowerment should challenge and change the cultural norms about how gender roles and socialization play out in patriarchal dominated societies (Mohanty et al., 2020; Tiwari, 2010) like Zimbabwe.

Designers and developers of ICTs should consult and consider the needs and aspirations of women to produce technology that does not discriminate against women (Zheng 2009) in terms of use and ergonomic designs. Gill et al., (2010) recommend the participation of women in all stages from designing and implementing technology to ensure its utility in women-run SMEs.

Furthermore, ICTs should be affordable and available to women entrepreneurs. A study by Tiwari (2010) cites the lack of access to cheap finances as one of the major barriers to adopting ICT in women-led businesses. Availability of finances and affordable ICTs helps women to buy technological gadgets and conduct their businesses over the internet. Thus, the government and other stakeholders should provide a regulatory environment by allocating finances to women and formulating taxation policies to promote women's access to ICTs (Mohanty et al., 2020).

In Zimbabwe, Musungwini et al., (2020) advocate for a 50% diversity rule in ICT training at universities and colleges. They also argue that female students should be exposed to ICT gadgets at a tender age in primary and secondary schools. This early exposure to ICTs could generate interest to use and adopt ICTs later in their businesses. Besides this early exposure, and as already discussed above, the government of Zimbabwe should also craft gender-based policies to increase ICT adoption by SMEs.

3.4.3 **Zimbabwe ICT infrastructure**

Access to ICT by SMEs is essential for the growth of the Zimbabwean economy. According to the African Development Bank (AfDB)(2019, p. 22), "a 10% increase in broadband penetration contributes 1.38% GDP growth." Low ICT infrastructure constraints competitiveness and sustained growth of SMEs. The AfDB (2019) report on Zimbabwe shows that Zimbabwe's poor political and economic outlook has reduced ICT growth over the past decade, consequently reducing the growth of SMEs. Zimbabwe is still behind in terms of ICT infrastructure (e-readiness). According to the AfDB report, Zimbabwe's e-readiness is ranked at 124 out of 139 developing countries.

A good ICT infrastructure is very important for economic growth; it facilitates the quick flow of information vital for decision-makers (AfDB, 2019; Schwab, 2018). The ICT infrastructure is a vast concept incorporating many components. The definition of ICT infrastructure is well captured by Bukht and Heeks (2017). They define it as broadband connectivity, human capital (skills) and digital technology integration and usage for individuals, businesses, and public administrations. From this definition, a good ICT infrastructure should include the following: An acceptable ICT policy, cost, telecommunication infrastructure, internet connectivity and adequate, reliable electricity supply (Makiwa & Steyn, 2018). The following section highlights how these ICT infrastructure components are essential for adopting ICT (cloud) adoption in Zimbabwe.

3.4.4 **Zimbabwe ICT Policy**

As already mentioned previously, SMEs in Zimbabwe face a barrage of challenges ranging from a low business environment, archaic government ICT policies, a dearth of managerial skills and poor ICT infrastructure (Makiwa & Steyn, 2018). The first ICT policy document was launched in 2007. However, it became obsolete due to the ever-changing IT landscape (Karaiza, 2018) and the lethargic and bureaucratic tendencies of the Zimbabwean government to implement its policies on time. A new ICT policy was developed in 2015 and was only to be officially launched in 2018, three years down the line after the document was again overtaken by new developments in the IT sector and has become antiquated (Karaiza, 2018). Zimbabwe government has also been criticised for being lethargic regarding policy implementations (Makiwa & Steyn, 2018). According to the MISA Report (2018), the Zimbabwean government missed the 17 June 2015 International Telecommunications Union (ITU) and missed the June 2016 deadlines to migrate from analogue to digital infrastructure due to lack of resources.

According to the AfDB report (2019), Zimbabwe lags behind other regional countries regarding ICT penetration and the rate of adoption of emerging technology. Though the government, according to its ICT policy, seeks to deepen the use of ICT in the economy, e-government and e-learning programmes (Zimbabwe ICT Policy & 2016) not much has been done on the ground in terms of implementation of the policy. Furthermore, in addition to this, there is no cyber-security policy in Zimbabwe, and this presents significant challenges in terms of digital information security (AfDB, 2019).

3.4.5 **Mobile and Internet penetration.**

In terms of mobile penetration rate, Zimbabwe is ranked favourably compared to other African countries. According to The Business Connect (2019), Zimbabwe has a mobile penetration rate of between 90% and 100%. However, the high penetration rate does not translate to Internet use. Even countries with high Internet penetration rates do not effectively use the Internet, for example, Rwanda, like Zimbabwe, has a penetration rate of more than 90% internet coverage, but surprisingly only less than 10% of the population effectively use the Internet (Mothobi, 2019). The use of the Internet in Africa is still very low, and research shows that, on average, only 7% of SMEs effectively use the Internet to conduct their business (A4AI, 2019; Mothobi, 2019).

Some scholars argue that governments should not only focus on high figures of penetration rate, but also on meaningful accessibility. According to Alliance for Affordable Internet (A4AI)(2019) meaningful accessibility or connection includes using a proper device to access the Internet, the right connection speeds to enhance the Internet experience, enough data and frequency of connection. Meaningful accessibility measures the use of the Internet from any device in the last three months and the quality of connection (A4AI, 2019). Everyone has a right to access the right information at the right time. The United Nations has declared Internet access as a human right. Any government that does not afford meaningful access to ICT to its citizens is violating its citizens' human rights; thus, it should be held accountable (A4AI, 2019). One of the Sustainable Development Goals (SDG) set by the United Nations is universal access to affordable internet access by 2020(A4AI, 2019; Mothobi, 2019). It is a tall order for Zimbabwe's government considering that according to AfDB (2019), Zimbabwe's e-readiness is ranked at 124 out of 139 developing countries. It is not a favourable position to occupy, especially if the government wants to harness the benefits of ICT to improve the country's economy and the general welfare of the citizenry.

Zimbabwe still lags behind its neighbours and the globe in terms of the Network Readiness Index (NRI). The NRI accesses policies, factors and institutions that enable a country to reap the benefits of emerging technologies (Adam, Abd Elmutalib, & Mohamed, 2019). The NRI shows that African countries occupy marginal positions in using ICT to improve their citizenry's welfare. INSEAD (2016) report shows that there are sixteen African countries in the bottom twenty less networked countries globally (INSEAD, 2016). In Sub-Saharan Africa, South Africa has the highest NRI at number 65 in the world. Zimbabwe is ranked lowly at number 122 out of 139 ranked countries of the world. Regionally Zimbabwe also lags marginally behind its neighbours. Therefore, the government of Zimbabwe should address the ICT infrastructural and affordability challenges faced by many users to improve meaningful accessibility.

3.4.6 Cost and affordability

Research shows that the cost of Internet access is dropping fast, but not as fast in Africa. Most people in Africa cannot afford to buy 1GB of data (A4AI, 2019). Internet affordability is when at least 1GB of data is not priced at more than 2% of the average income. However, across Africa (currently, 2019) 1GB of data costs 8% of average income compared to 2.7% in the Americas and 1.5% in Asia (A4AI, 2019). This is not surprising at all because mobile and Internet penetration are aligned with gross domestic income (GDI) per capita, and globally African countries have the lowest GDI per capita as mobile phone and Internet (Gillwald, Mothobi, & Rademan, 2018).

Zimbabwe, according to The Cable (2019), has the most expensive mobile data in the world, pegged at US$75.20 per 1GB of data. This ridiculously high cost of data creates a social and economic divide. The high cost limits meaningful access to data, forcing SMEs to use basic IT applications like Facebook, Twitter and WhatsApp that may not fully enhance business processes (Makiwa and Steyn, 2019). The publication by Cable (2019) is, however, refuted by Mothobi (2019). Mothobi (2019) puts the cost of data in Zimbabwe at US$20 per 1GB, which is still one of the most expensive in Africa and the world. The research by Mothobi is collaborated by Zimtec Review (2019), which puts the cost of data fractionally above US$20 to US$25 per 1GB. Comparatively, Zimbabwe still has one of the most expensive data in the SADC region. According to The Cable (2019) in Rwanda, 1GB of data costs US$0.56, the Democratic Republic of Congo (DRC) US$0.88 and South Africa is pegged at US$7.19. Clearly, this shows that Zimbabwe has probably the most expensive data in Africa, which widens the digital divide.

3.4.7 Electricity Supply

Affordable and reliable electricity supply is an essential component of ICT infrastructure. However, inadequate electricity supply has hampered SMEs' operations in developing countries, especially Sub-Saharan African countries (Forkuoh & Li, 2015). One of the reasons for the digital divide between rural and urban areas is unreliable electricity. Electricity is used to power data centres, ICT devices and transmission boosters.

The unavailability of electricity is a significant factor that hinders the growth of SMEs. According to the African Development Bank (2018), more than 640 million Africans do not have access to electricity. The same study concludes that only 40% of the African population has access to electricity which is the lowest globally. Electricity directly impacts "productivity and economic growth" (AfDB, 2018, p. 89). Lack of electricity pushes up the cost of doing business, and SMEs are the most affected. In areas where electricity is available, it does not come cheap; it is costly, and most SMEs cannot afford it. On average, in Africa, electricity costs US$0.20 per KWh, which is four times higher than anywhere else in the world (AfDB, 2018; Ndiaye et al., 2018). The high cost of electricity may force some SMEs to illegally connect and steal electricity from the national grids, prejudicing the government of millions of dollars on revenue and endangering people's lives in and around the SMEs premises.

Electricity in Africa is unaffordable and unavailable, and unreliable (Ndiaye et al., 2018). Research by African Developing Bank (2018) indicates that 79% of Africa firms experience electricity load shading for 5.7 hours per week and (per day in some countries). This situation negatively impacts SMEs' growth, preventing them from reaching their desired potential (Ndiaye et al., 2018). Zimbabwe is facing an acute shortage of electricity (as of 2019) and has embarked on a daily 18-hour load shedding scheme countrywide (Chikono & Kuwaza, 2019). This shortage is mainly due to ageing infrastructure dating back to the 1950s that has lacked sustained maintenance and recapitalisation over the years (AfDB, 2019). AfDB (2019) also advises that relying too much on hydroelectricity puts pressure on the electricity supply, especially amid erratic weather.

According to AfDB (2019, p. 21) "An efficient and viable electricity sector will ensure economic stability and growth, given the forward and backward linkages with the rest of the economy." Thus, inadequate and unreliable electricity supply negatively impacts both cost competitiveness and investment decisions of SMEs (Nyanzu & Adarkwah, 2016). A country with a high frequency of power outages usually has few SMEs in the manufacturing sector, which requires enormous amounts of power (Forkuoh & Li, 2015). Evidence from the research also shows that SMEs' failure rate due to insufficient electricity supply is very high in developing countries (Nyanzu & Adarkwah, 2016). In Nigeria, between 2000 and 2008, about eight hundred twenty SMEs closed because of insufficient electricity supply (Forkuoh & Li, 2015). In Rwanda, fifteen SMEs close every month due to a shortage of electricity (Mugabo, 2018).

Mobile networks operators in the country have lost expensive equipment due to power surges and outages. Furthermore, intermittent electricity supply results in network failure, erratic service, and internet service unavailability, causing SMEs to fail to transact over the Internet (Zvavanjanja, 2019). Some scholars have advocated for clean energy like solar energy to augment the erratic grid electricity.

3.4.8 **Telecommunication infrastructure**

Telecommunications infrastructure directly affects the economic growth of a country (OECD, 2019). As already mentioned in Section 3.5.2, a 10% increase in broadband penetration contributes 1.38% GDP growth (AfDB, 2019). Unfortunately, currently (2019), Zimbabwe suffers from poor telecommunication infrastructure; broadband communication is not available in many countries (International Labour Office, 2018).

Rural areas are still underdeveloped in terms of network coverage. According to network providers, setting up adequate and quality telecommunication infrastructure is costly and unprofitable due to low services demand (Gwaka, May, & Tucker, 2018). This lack of telecommunications infrastructure in Zimbabwean rural areas widens the urban-rural digital divide (AfDB, 2019), thus, economically excluding SMEs in rural areas. Research shows that governments in developing countries are not well resourced. There is no political will to commit adequate resources to rural areas, more so the private sector is unwilling to invest expensive infrastructure that will be underutilised (Gwaka et al., 2018; OECD, 2019).

Research by AfDB (2019) and the OECD (2019) reports that the digital gap that existed between big corporates and SMEs in terms of connectivity has been dramatically narrowed, but unfortunately, the gap is said to have widened in terms of meaningful participation in the e-commerce (AfDB, 2019; OECD, 2019). The research attributes this to unawareness of the enormous benefits of ICT and also lack the prerequisite skills. It is currently difficult for the Zimbabwean government to skill SMEs because it has not yet fully embraced ICT within its operations. Most of its operations are still manual (AfDB, 2019; Gwaka et al., 2018; International Labour Office, 2018). Proactive governments in developed countries provide cutting-edge ICT infrastructure to SMEs regarding affordable cost, telecommunications infrastructure, internet connectivity and electricity supply (Makiwa & Steyn, 2018).

Postal and Communications Authority (POTRAZ), Zimbabwe's government should open up and offer more telecommunications licences to more players to enhance competition through its regulatory authority. Presently, there are only three mobile operators, Econet, Netone and Telecel. According to AfDB (2019), the lack of competition among network providers constrains investment in high-capacity networks and prevents the market from achieving economies of scale.

3.4.9 **Zimbabwe Regulatory Framework**

Three ministries are responsible for the regulation of information and technology. These are the Ministry of Information Communication Technology, Postal and Courier Services, Ministry of Information, Publicity and Broadcasting Services and the Ministry of Higher Education, Science and Technology Development (Zimbabwe ICT Policy & 2016). Two leading regulatory agencies regulate different sectors of ICT, and these are the Postal and Communications Authority (POTRAZ) and the Broadcasting Authority of Zimbabwe (BAZ) (Zimbabwe ICT Policy & 2016). POTRAZ is mandated to offer licences to operators in telecommunications and Internet services and level the playing field for new entries. At the same time, BAZ is required to oversee broadcasting related services. BAZ also grants some broadcasting licences to new operators.

There is a thin line between the services of BAZ and POTRAZ because some of BAZ's functions are subsumed in POTRAZ, resulting in overlapping and duplication of functions between these agencies (AfDB, 2019). Both agencies are mandated to manage radio frequencies and regulate the electronic transmission of information and data (AfDB, 2019; Gwaka et al., 2018; MISA, 2018). Some scholars argue that the two regulatory agencies are politically driven and hence caution that there is a need to shift from these politically centred regulatory frameworks to more technocratic centred regulatory frameworks (Adam et al., 2019; Gwaka et al., 2018).

There is no synergy between the two regulatory agencies, and hence the overlapping and duplication of functions between the two impede efficient development and harmonisation of efforts (AfDB, 2019). The confusion bottlenecks the process of modernising the ICT sector.

The government should fuse the existing duplication of the two regulatory frameworks to create a more friendly single regulatory authority for the ICT sector. The government should also draft, with urgency, a cybersecurity framework (as of 2019, Zimbabwe does not have a cybersecurity framework) to maintain cybersecurity, integrity and confidentiality of data

(Adam et al., 2019; AfDB, 2019; Gwaka et al., 2018). Availability of cybersecurity framework could increase the rate of technology adoption by SMEs as one of the significant reasons why SMEs are reluctant to adopt new technology is the issue of their data security (Al-Hujran et al., 2018; Budiono et al., 2018; Z. Khan, Pervez, & Abbasi, 2017). Additionally, the government must also develop a framework to help SMEs adopt modern technologies like cloud computing.

Of necessity, Zimbabwe's government must also put some incentives to help SMEs adopt new technology in its regulatory policy framework. In Indonesia, the government embarked on the National Movement of 1000 New Digital Startup initiative in which 1000 SMEs are helped digitise their organisations yearly (Budiono et al., 2018). In Ghana, the government promulgated two policies to help in the growth of SMEs. It initiated ICT for Accelerated Development (ICT4AD) and the National Telecommunication Policy (NTP); the ICT4AD encourages people to use ICT as a socio-economic development tool and NTP to improve IT communications infrastructure (Adane et al., 2019; Obinkyereh, 2017). The Zimbabwean government should also embark on a training spree to skill the population in IT use. To reap maximum benefits from ICT, people should possess the skill to use it. Research in Ghana on SMEs' dilemma to adopt ICT is poor ICT skills, high cost, and the risk associated with investing in ICT (Adane et al., 2019).

To circumvent these challenges, SMEs must embrace new beneficial technology. Kelly (2012, p. 12) aptly describes beneficial technology as a "potentiator source of possibilities and options." Research shows that SMEs grow two to three times faster when they adopt technology (Kabanda & Brown, 2017). Technology gives SMEs a competitive edge and stamina in the global markets. Adane et al. (2019) argue that using ICT is a catalyst for business processes, helps achieve competitiveness, and contributes to SMEs' sustainability. Some studies have shown a positive correlation between IT usage and sales volume, profitability, and market penetration (Bahrini & Qaffas, 2019; Kabanda & Brown, 2017; Niebel, 2018). Cloud computing has been touted as a panacea for both SMEs and established businesses to equal chances to be competitive on the global markets (Rohani, 2015). Kabanda and Brown (2017) argue that cloud computing "can lower IT barriers to innovation" by providing all applications to SMEs on the Internet. Thus, cloud computing helps SMEs reduce the rates spent on computing infrastructure (N. Khan & Al-Yasiri, 2016; Nguyen et al., 2015). This leaves the SMEs to concentrate on the core business without worrying about installing sophisticated hardware and software at their business premises.

Cloud computing is both a business and technology concept (Adane, 2018; Rahmi et al., 2012); therefore, businesses must embrace this new business and technological paradigm. Rohani (2015) argue that cloud computing offers both operational and strategic advantages to an organisation. Makena (2013) extols that cloud computing provides several advantages, both strategic and operational, to its adopters. Cloud computing gives SMEs a competitive advantage over other organisations that are still using obsolete traditional IT systems (Adane et al., 2019). According to Sahandi, Alkhalil, and Opara-Martins (2013, p. 8) "cloud computing can play a major role in addressing inefficiencies and make a fundamental contribution to the growth of enterprises mainly for SMEs." This growth is both endogenous and exogenous. Endogenous growth is internal organisational growth that includes improving business systems while exogenous growth improves its visibility and share on the global market.

Unlike traditional computing models, cloud computing is independent of location. Therefore, company services can be accessed from anywhere, as long as there is access to the Internet (N. Khan & Al-Yasiri, 2016; Nguyen et al., 2015; Yeboah-Boateng & Essandoh, 2014). Also of importance is that cloud computing can be accessed on a wide variety of devices, regardless of the local hardware on which the software is (Bayat, Pomplun, & Tran, 2014; Nguyen et al., 2015). This is a relief to forgetful employees that can forget important documents at company premises or the employees who travel a lot because they can access documents from anywhere as long, they are connected to the Internet.

SMEs, by their size, are affected by initial high IT capital investment costs. The advantage of cloud computing technologies is that they allow SMEs to access IT infrastructure without the need to buy servers, applications, and other related tools, but to only pay for the services they use (Alkhalil et al., 2017; Makena, 2013; Nguyen et al., 2015). Cloud computing is a 'pay as you use' scheme so SMEs will pay only for operating costs because upfront capital investments and other costs like maintenance costs are the cloud provider's responsibilities (Mehta & Suriyanarayanan, 2013, p. 7). However, SMEs still face challenges in adopting some technologies like cloud computing. The following section highlights some challenges faced by SMEs to adopt cloud computing.

3.5 CHALLENGES OF ADOPTION OF NEW TECHNOLOGIES

Aside from the advantages mentioned above, SMEs in developing countries still struggle to adopt new technology in their business processes (Alkhalil et al., 2017; Nguyen et al., 2015). A study by United Nations Conference on Trade and Development (UNCTAD)(2018) suggests that new technology has outpaced societies' ability to adapt to changes created by technology and hence gives rise to ambivalence and hatred towards the use of technology. However, some studies suggest that SMEs are either unaware or unsure of how to migrate to the cloud (Al-Hujran et al., 2018; Nguyen et al., 2015; Rashmi & Sahoo, 2012). The SMEs have no or limited knowledge on how to guide their organisations to the cloud and have no knowledge on how cloud computing can positively transform their businesses (Buyya, Broberg, & Goscinski, 2010; N. Khan & Al-Yasiri, 2016).

Research also shows that the rate of cloud computing adoption is slow in SMEs and that the failure rate is very high (Chang & Barun Dasgupta, 2015; Nguyen et al., 2015). Some researchers argue that the high rate of failure is due to an improper adoption plan. Cloud computing adoption by SMEs has been extensively researched (Adane, 2018; Adane et al., 2019; Erind, 2015; Harfoushi et al., 2016; Z. Khan et al., 2017; Lynn et al., 2018; Nawaz, Malik, Shafi, & Khan, 2015; Rukhsara, Aklam, Nawer, Chauhan, & Islam, 2016; Sağ, Sezen, & Güzel, 2016; Stieninger, Nedbal, Wetzlinger, Wagner, & Erskine, 2018; Widyastuti & Irwansyah, 2018). Some studies argue that SMEs in developing countries are hesitant to adopt IT because of the high failure rate of IT projects (Nawaz et al., 2015; Skafi, Yunis, & Zekri, 2020). Amini and Bakri (2015) assert that 20% of IT projects are cancelled before completion, and less than one third are finished on time within the allocated budget and with the desired functionality. This assertion scares away SMEs from adopting IT solutions and consequently slows down the rate of IT adoption. Other factors like security, privacy, trust and compatibility also tend to slow down the IT adoption rate (Al-Hujran et al., 2018).

According to Nguyen et al. (2015), SMEs just rush to adopt new technology because of the hype and euphoria associated with the new technology without proper research and planning. Lack of proper planning makes the organisation travel very far in all directions going nowhere, thus making the adoption process a futile and expensive exercise. Carson, Gilmore, Perry, and Gronhaug (2001) in Nguyen et al. (2015) argue that most new SMEs have no concrete plans in place and they experience ambiguity and uncertainty regarding adopting new technology.

Al-Hujran et al. (2018) and Khajeh-Hosseini, Greenwood, Smith, and Sommerville (2012) reckon that successful cloud computing depends on the maturity and the culture of the organisation. An organisation with a strong foundation for execution can adopt cloud computing faster than an organisation that predominantly uses traditional IT systems. Foundation for execution means that a company has IT infrastructure in place, digitised processes and, most importantly, automated core capabilities (Ross, Weill, & Robertson, 2006). Other studies argue that the impact of technology on society depends on the structure of a country's economy (AfDB, 2019; UNCTAD, 2018). Countries with well-developed economies have fully interactive and transactive IT systems, and the whole society is digitised.

Adopting cloud computing changes the organisational culture and can seriously affect how people are used to working in the organisation (Widyastuti & Irwansyah, 2018). Some research on modern management challenges report that adopting cloud computing can erode the IT department's authority once wielded, thus effectively turning them from 'users into choosers' (Khajeh-Hosseini et al., 2012; Serban & Iorga, 2016). Cloud computing adoption is not just a technological issue but a fundamental change in how things are done in and out of the organisation. Therefore, to bring real value, cloud computing should align with the organisation's business processes (Alkhalil et al., 2017; Gupta, Misra, Kock, & Roubaud, 2018; Huygh, De Haes, Joshi, & Van Grembergen, 2018).

Some researchers argue that the slow adoption of emerging technology by SMEs could result from a lack of resources. AfDB (2019) and Nguyen et al. (2015) observe that in most cases, owners and promoters of SMEs end up mortgaging their possessions to finance the adoption of new technology, with the hope that the technology should deliver the promised benefits as soon as possible.

Cost calculations are difficult to quantify due to many variables in the adoption equation. Al-Hujran et al. (2018) and Khajeh-Hosseini et al. (2012) observe that it is challenging to understand operational costs instead of capital costs. They further argue that it is difficult to estimate the cost of actual resources consumed by the system as they depend on the load and that the cloud service provider's pricing scheme can change anytime. The other challenge is matching hardware and software to seamlessly run the business applications to the satisfaction of the owners of SMEs (N. Khan & Al-Yasiri, 2016).

Business markets have become too sophisticated and very volatile (Yeboah-Boateng & Essandoh, 2014). Competition for access to the worldwide markets has become so inflexible ((Aljabre, 2012) that only the established businesses can still enjoy the market monopoly. The small businesses with little financial muscle have been worse affected. Many SMEs in developing countries lack the financial capital to invest in emerging technologies (Yeboah-Boateng & Essandoh, 2014). Some SMEs still use traditional IT systems have become obsolete and cannot match the ever-changing technological business environment. SMEs are encouraged to adopt new technology, like cloud computing, where there is no need for huge upfront capital investments to be globally competitive.

Cloud computing is not a new phenomenon; John McCarthy has been widely credited with proposing computing as a utility in 1961 (Vithayathil, 2018). However, over many years cloud computing has been developed and has evolved out of distributed, grid, and utility computing (Palos-Sanchez, 2017). Because of this evolution, it is logical to understand the contemporary meaning of cloud computing first and then know the layered structure, the architecture of cloud computing, and the deployment models in that order.

3.6 DEFINITION OF CLOUD COMPUTING

There are several definitions of cloud computing. Cloud computing can be defined in several different ways, and this depends on the users' perspective. This section presents seven different definitions of cloud computing.

- Armbrust et al. (2010) define cloud computing as the aggregation of the application delivered as services over the Internet and hardware and systems software in the datacentres that provide those services.
- Widyastuti and Irwansyah (2018) define cloud computing as a technology that allows a person or an organisation to store documents on this network and allows that same document to be accessed on computers or other devices outside the network.
- Marston, Li, Bandyopadhyay, Zhang, and Ghalsasi (2011) define cloud computing as an information technology service model in which computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of device and location.
- Sarna (2010) defines cloud computing as an elastically scalable, virtualised system that can be rapidly provisioned with a flexible pricing model (pay as you go).
- Cloud computing is a platform to provide on-demand with a shared pool of resources to end-users across the globe using the Internet (Chowdhury, 2014).
- (Harfoushi et al., 2016) define cloud computing as a technology for providing highly scalable services which empower IT managers to adjust to changing business requirement by easily obtaining and releasing computing services as needed.

From the above definitions, the central theme is that cloud computing is both a technology and a business concept that is dynamically provisioned to customers over the Internet on a pay as you use basis. Although (Mell & Grance, 2011) definition has been widely quoted in the literature, some scholars criticise it as being more technical and weaker in articulating the business aspects (Alhammadi, 2016). However, this research is premised on the (Mell & Grance, 2011)) definition. It is believed that the definition covers a wide range of things, and it is robust. It highlights three service models (IaaS, PaaS and SaaS) and four deployment models: private, public, hybrid and community (Li, Yu, Li, Zhao, & Zhao, 2019). The definition also captures several characteristics of what cloud computing can do to different organisations (Caithness, Drescher, & Wallom, 2017). The following Sections, 4.3 and 4.4, describe the three service models (cloud computing architectures) and the four deployment models depicted in the (Mell & Grance, 2011) definition, respectively. Section 4.5 highlights the different characteristics that differentiate cloud computing from other computing technologies.

3.7 CLOUD SERVICE MODELS (CLOUD COMPUTING ARCHITECTURES)

Cloud computing services are provided to users in a layered structure, which includes software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS), as is evident from Figure 4.1 below. Each layer represents a different service offered by cloud computing, and "this is dependent on the level of abstraction and resources they provide" (Adane et al., 2019, p. 2). The cloud service model describes how the cloud environment is configured to meet different users' requirements. Each layer in the model has its own benefits and SMEs, and indeed other organisations should select the best layer according to their needs. Again, the SMEs should be aware of these service models to choose the best model according to their needs. The following section briefly describes each of the architectures mentioned above (Figure 4.1 below).

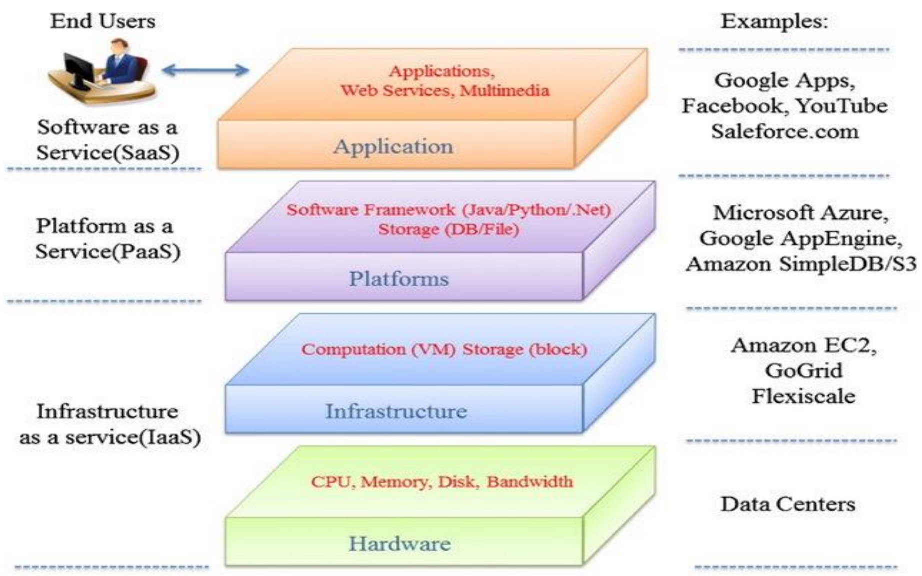

Figure 3-2: Cloud Computing architecture (Source: Q. Zhang, Cheng, and Boutaba (2010)).

3.7.1 **Software as a service (SaaS)**

This is a visible layer (cloud applications) that provides interaction between users and the hardware. SaaS is a prominent cloud architecture that is consumed by many businesses (SMEs included) (Bildosola, Río-Belver, Cilleruelo, & Garechana, 2015; Li et al., 2019). It is similar to getting into a taxi to a particular predefined destination. One can only pay for the ride and not be concerned about serving the car, buying fuel, car insurance or road tax. All these are taken care of by the owner of the vehicle.

In the same way with SaaS, the users can access all that they require and pay only for what they have used. There is no need to buy, install, maintain or upgrade any software; the users will simply access all they need through the Internet (Palos-Sanchez, 2017). For example, users can access web-based software using their web browsers without the need to install and maintain any software(Amini & Bakri, 2015; Harfoushi et al., 2016; Hassan, Mohd Nasir, & Khairudin, 2017; Hsu & Lin, 2016). SaaS offers a whole user experience from basic applications like word processors to more complex and specialised applications like Customer Relationship Management (CRM), Enterprise Resource Planning (ERP) and Management Information Systems (MIS) (Bildosola et al., 2015). These applications are what SMEs use on a daily basis, from basic to more specialised applications (Choudary, 2019). For example, Microsoft Office 365 is a software application that, in all respects, resembles the traditional Microsoft Office (Word, Excel, and PowerPoint). It provides an online facility to create documents on the cloud, and users can access it over the Internet, unlike the traditional Microsoft Office that required a licence to be installed on computers (Chaudhary, Aujla, Kumar, & Rodrigues, 2018; Li et al., 2019). This is an advantage, especially to SMEs, because it reduces upfront IT investments, and therefore there will be no need to invest in expensive hardware and software (Palos-Sanchez, 2017).

3.7.2 Platform as a service (PaaS)

This layer is between the application layer and the core infrastructure. The layer includes hardware as a service, data as a service and software as a service. The platform's software environment contains a well-defined application user interface, including operating systems, programming language execution environment and web servers (Palos-Sanchez, 2017). PaaS is similar to renting a car to take one to a particular destination. The person who rents the car will have to take care of the fuel needs of the car and road tolls. Like car insurance and car servicing, all other things are taken care of by the car owner. Likewise, PaaS will provide a secure cloud environment and core computing services like storage, network and virtualisation and customers can install their own applications but will not be responsible for maintaining the underlying infrastructure (Choudary, 2019; Hsu & Lin, 2016). In other words, the customer has control over the applications but does not have control over the embedded cloud infrastructure (Palos-Sanchez, 2017). Microsoft's Azure and Google Application Engine are cited as good examples of PaaS (Alkhalil et al., 2017; Choudary, 2019; Hsu & Lin, 2016).

3.7.3 Infrastructure as a service (IaaS)

This service constitutes IT equipment managed and maintained by the cloud provider (Alkhalil et al., 2017; Li et al., 2019). It combines hardware infrastructure that supports platforms as services and applications as services (Amini & Bakri, 2015; Harfoushi et al., 2016). IaaS allows users to access infrastructure resources, such as servers, storage devices, virtual computers, and backup recovery services (Hsu & Lin, 2016). This can be compared with someone who wants to travel to a faraway place and chooses to lease a car. The lessee will have to take care of almost everything, serving the vehicle, paying for fuel, insurance and road tolls. Most of the things are carried out by the lessee. The leaser will just take care of finances related to the car (Choudary, 2019).

In the same way, IaaS offers customers basic infrastructure like storage, security, networking and backup services on a pay as you use basis (Choudary, 2019) and customers will have to handle most of the workload like installing software, maintaining and managing software layers. IaaS is the best option if one needs to control the hardware infrastructure (Harfoushi et al., 2016; Li et al., 2019).

Figure 4.2 below summarises characteristics of cloud computing architectures (cloud service models) and of interest are compared to the on-premises IT department (in-house IT department). The diagram shows what users and vendors manage as part of the architecture.

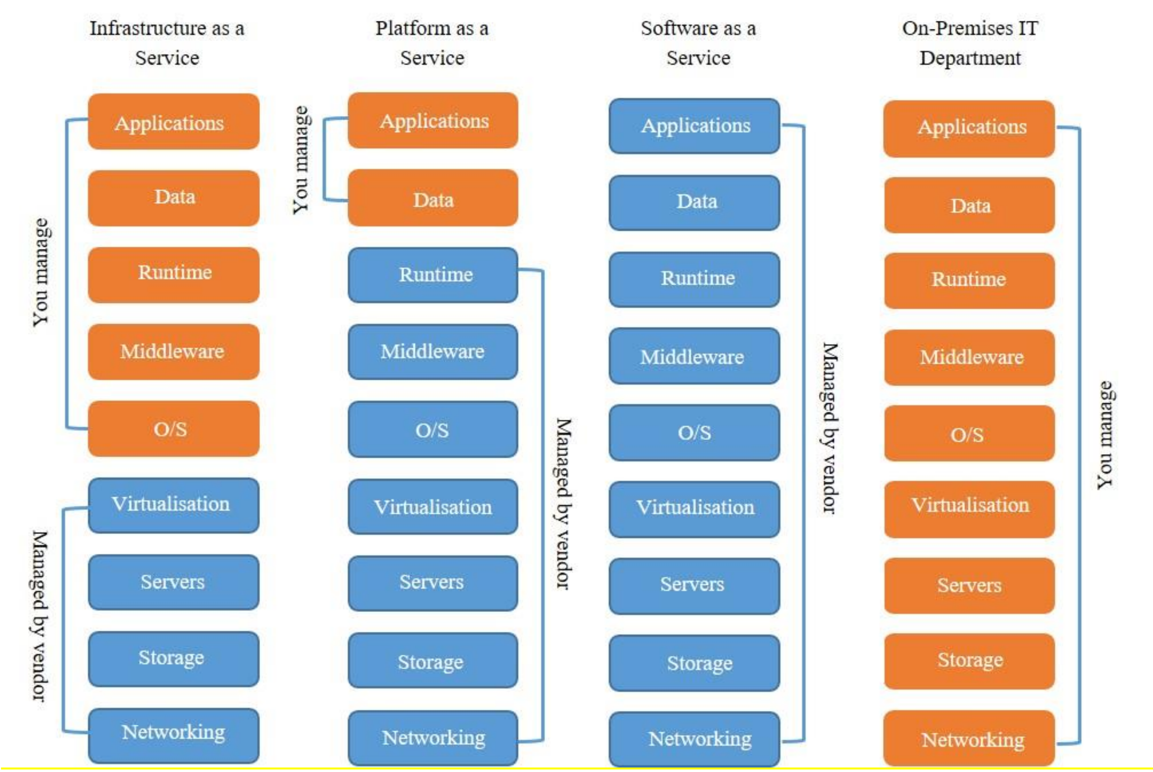

Figure 3-3: Comparison of cloud service models (Choudary, 2019).

Now that the architectures of the service models of cloud computing have been discussed, it is also necessary to provide an overview of cloud computing deployment models.

3.8 CLOUD COMPUTING DEPLOYMENT MODELS

Cloud computing has four deployment and service models. A deployment model describes how one accesses the cloud service providers' different cloud services (Choudary, 2019). According to Laszewski and Nauduri (2012), a cloud model shows how cloud computing services are being made available to different users.

The SMEs should have the necessary information about these models to be informed and select an appropriate model to suit their needs. Cloud deployment models include public cloud, private cloud, community cloud and hybrid cloud. Each of these models is briefly described below.

3.7.3 **Private Cloud**

It is a type of cloud deployment in which the cloud is exclusively for one organisation (Changchit & Chuchuen, 2018). The cloud can be managed by the organisation or by a third party on-site or off-site (Attaran & Woods, 2019). With this type of cloud, an organisation has control over the infrastructure and the day to day running of the cloud; hence it is very secure in terms of data security (Adane, 2018; Attaran & Woods, 2019; Lee, 2019). However, it is costly to run; hence it is suitable for established large corporations (Adane, 2018; Attaran & Woods, 2019; Lee, 2019).

3.7.4 **Public Cloud**

This type of cloud is owned, managed, and operated by a business, academic or government organisation, or some combination (Mell & Grance, 2011), made available to the general public (Attaran & Woods, 2019). The service on this cloud is available to the public on-demand, that is, the public only pays for what they consume in terms of bandwidth, storage or Central Processing Unit (Attaran & Woods, 2019; Changchit & Chuchuen, 2018). Google Apps is one example of a public cloud that is suitable for both SMEs and large corporates. This type of cloud is cheap in terms of the cost of services but relatively unsafe in terms of security. Organisations that deal with sensitive data are discouraged from using this kind of cloud.

3.7.5 **Hybrid Cloud**

It is a combination of two or more clouds to get maximum benefits at a reasonable cost. It is a flexible type of cloud infrastructure in that organisations can move their data between the two infrastructures when necessary (Attaran & Woods, 2019). An organisation has full control over what to move to the cloud and what data remains within the organisation. Generally, it is recommended that organisations should keep non-critical data in the public cloud while sensitive data are kept in the private cloud (Attaran & Woods, 2019; Changchit & Chuchuen, 2018). This type of cloud infrastructure is likely to be cheaper than the private cloud.

3.7.6 **Community Cloud**

Senyo, Effah, and Addae (2016) define a community cloud as a cloud that is owned or operated by one or more of the organisations in the community, a third party, or a combination of them that share a common interest.Attaran and Woods (2019) reiterate that this type of cloud is run by organisations with similar security, privacy, performance and compliance requirements. SMEs share some common characteristics, such as individual entities that are small, less developed IT infrastructure and in most cases, they lack the financial clout to enhance their businesses and hence this type of cloud could be suitable for them. Economies of scale dictate that this type of cloud would be cheaper than any other type of cloud because it is operated by a group of organisations that share similar business missions, and hence, they can share the operation costs (Changchit & Chuchuen, 2018).

The choice of a cloud deployment model depends on the level of IT maturity of an organisation. For example, Keung and Kwok (2012) observe that SMEs with high standardisation and automated business processes have a high IT maturity level and are recommended to use a private cloud. SMEs with low IT maturity can choose a cheaper public model.

In choosing a specific model, one also has to understand the characteristics of cloud computing in order to make an informed decision on the type. The following section describes some characteristics of cloud computing.

3.8 CHARACTERISTICS OF CLOUD COMPUTING

The following characteristics of cloud computing are adapted from Mell and Grance (2011). These five cloud computing characteristics differentiate cloud computing from other computing technologies:

- On-demand self-service; the consumer is provisioned with computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
- Broad network access, where the capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).
- Resource pooling, which allows the provider's computing resources to be pooled to serve multiple consumers using a multitenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.

- Rapid elasticity, where capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand; and
- Measured service, where cloud systems automatically control and optimise resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts).

The above characteristics show that cloud computing enables organisations/SMEs to utilise computing resources such as servers, networks, storage, development platforms, and software applications provided by a cloud service provider. These services can be accessed when needed, on-demand and organisations only pay for what they have used. There is no need to own computing infrastructure; therefore, this computing paradigm should be suitable for SMEs. The following section discusses some perceived benefits accrued to SMEs when they adopt cloud computing.

3.9 BENEFITS OF CLOUD COMPUTING TO SMES

Cloud computing is crucial not only at the micro-level for SMEs to achieve a competitive advantage but also at the macro level to improve living standards. Numerous studies have been carried out to show the benefits of cloud computing to different organisations (Adane, 2018; Adane et al., 2019; Erind, 2015; Harfoushi et al., 2016; Sağ et al., 2016; Stieninger et al., 2018; Widyastuti & Irwansyah, 2018). Below are some of the well-documented advantages of cloud computing and how these benefits can support SMEs.

3.9.1 Increased competitiveness

Cloud computing can help SMEs increase their competitive advantage by reaching out to new customers and generating more profits in the process (Erind, 2015). Cloud computing creates new frontiers, markets and opportunities to expand business operations while at the same time deepening the niche of the existing markets (Al-Hujran et al., 2018). Research shows that adopting cloud computing increases productivity, increased efficiency, and increased speed of doing business (Adane, 2018; Erind, 2015; Widyastuti & Irwansyah, 2018). Cloud computing also offers SMEs to vertically integrate and network with other like-minded businesses (Erind, 2015).

3.9.2 **Cost-saving**

Once an organisation adopts cloud computing, there would be no need for capital expenditure on IT during the business's early formative years. Cloud computing allows SMEs to use "rental services for services provided by the cloud computing providers" (Erind, 2015, p. 242). The cloud providers provide all the services from storage services and maintenance, thus frees the cognitive resources of management to concentrate on core business operations for increased profitability (Widyastuti & Irwansyah, 2018).

3.9.3 **Flexibility and scalability**

Cloud computing resources respond according to the user’s requirements; that is, they can be increased or decreased as required to suit the user's needs. If the demand for the resources increases, the cloud resources automatically increase to meet the user's demands, a process called scalability (Sağ et al., 2016; Widyastuti & Irwansyah, 2018). SME data and cloud computing resources can be accessed from anywhere and on various devices provided one can access the Internet (Erind, 2015). According to Widyastuti and Irwansyah (2018), cloud computing adoption allows businesses to hold a meeting simultaneously with employees in different geographical areas via cloud services like SaaS.

3.9.4 **Technical skills support**

In-house IT department requires IT experts to run and maintain the department, which puts in some budgetary constraints on an organisation (Widyastuti & Irwansyah, 2018). All this will be unnecessary once an organisation adopts cloud computing because all support will be rendered by the cloud service providers (Chatzithanasis & Michalakelis, 2018; Sağ et al., 2016). This leaves SMEs with more resources at their disposal to expand and improve their core business operations.

3.9.5 **No need to purchase licences**

There is no need for SMEs to own IT infrastructure as everything is provided by cloud service providers (Sağ et al., 2016; Widyastuti & Irwansyah, 2018). The provision of software and software upgrades is the supplier's prerogative (Sağ et al., 2016). SMEs can access application files, emails and other services anywhere as long they have an Internet connection (Chatzithanasis & Michalakelis, 2018; Widyastuti & Irwansyah, 2018). With benefits, there are also some barriers to consider. The following sections highlight some of the barriers that hinder cloud computing adoption.

3.10 BARRIERS TO CLOUD COMPUTING ADOPTION BY SMES

The barriers to cloud computing adoption will now be addressed.

3.10.1 Employee resistance

Generally, employees in any organisation suffer from inertia, and they resist change. Over the years, they would have invested a lot in the current system, and change brings uncertainty because they fear their jobs (Lee, 2019). Employees are usually unwilling to change their working culture (Emani et al., 2018). On the other hand, managers perceive adopting new technology as difficult to adopt, costly, and disruptive (Emani et al., 2018; Mothobi, 2019; Widyastuti & Irwansyah, 2018). This perception by managers and the resistance offered by employees could be a result of lack of knowledge (Lee, 2019). Research shows that SMEs are less structured and professionalised to absorb new information from the external environment (Sağ et al., 2016). The reason could be that SMEs lack the required skills and necessary internal base to assimilate and integrate external knowledge base (Adane et al., 2019; Erind, 2015; Li et al., 2019; Sağ et al., 2016; Widyastuti & Irwansyah, 2018).

3.10.2 Incompatibility and trust issues

The new technology will not be adopted if it is at a tangent with an organisation's values, culture, and vision. Incompatibility issues as barriers to adopting new technology are well documented in the literature (Adane et al., 2019; Emani et al., 2018; Lee, 2019; Sağ et al., 2016; Stieninger et al., 2018; Widyastuti & Irwansyah, 2018; Yeboah-Boateng & Essandoh, 2014). The issue of control of data and infrastructure is also pertinent; users cede their control on their data and infrastructure to the cloud service provider in a cloud setup. Hence trust issues and data security, if they are not clear to users, act as barriers to adoption (Emani et al., 2018; Li et al., 2019; Stieninger et al., 2018).

3.10.3 Lack of standards among cloud providers

Research shows no common cloud standards among cloud providers (Adam et al., 2019; Chatzithanasis & Michalakelis, 2018; Erind, 2015; Li et al., 2019; Sağ et al., 2016; Stieninger et al., 2018; Widyastuti & Irwansyah, 2018). The problem of vendor lock-in is very well documented in the literature (Stieninger et al., 2018; Yeboah-Boateng & Essandoh, 2014). SMEs complain that it is difficult to switch from one cloud provider to another (Harfoushi et al., 2016). Lack of interoperability among cloud providers and high switch costs from one cloud provider to another dissuade SMEs from adopting the cloud (Emani et al., 2018). To increase the rate of cloud adoption, research advocates for homogeneity of products among cloud providers to enable SMEs and other cloud users to effortless switch from one cloud to another (Emani et al., 2018; Widyastuti & Irwansyah, 2018; Yeboah-Boateng & Essandoh, 2014).

3.10.4 The rapid evolution of the technology landscape

The technological world is ever-evolving and almost impossible to keep up with the pace, for example, there was a big hype on cloud computing, recently it was the Internet of things, Artificial Intelligence and Big Data, all these rapid technological advancements confuse and instil the spirit of despondency among users (Lee, 2019). Planning to adopt technology today may become obsolete tomorrow; consequently, some SMEs may find it unnecessary and futile to adopt a technology today, which few years down the line becomes obsolete (Chatzithanasis & Michalakelis, 2018; Stieninger et al., 2018).

3.10.5 Lack of IT specialists

Some SMEs may take time to decide to adopt cloud computing because they lack the necessary IT skills. Research shows that the use of PaaS and IaaS is considered quite complicated, thus requires sufficient skills to navigate through (Adane et al., 2019; Lee, 2019; Widyastuti & Irwansyah, 2018). The scientific field's complexity and lack of knowledge regarding cloud computing are cited in many research pieces as barriers to cloud computing adoption (Chatzithanasis & Michalakelis, 2018; Sağ et al., 2016).

3.10.6 Internet connectivity

Access to the cloud depends entirely on the Internet. In developing countries, access to the Internet is still a big challenge (Adane et al., 2019; Idris, Edwards, & McDonald, 2017; Karadağ, 2016; Widyastuti & Irwansyah, 2018). The other disadvantage is that the Internet connections are slow and of low quality, and above all, connectivity costs are very high and unaffordable (Adane et al., 2019; Agwu & Murray, 2015; Chatzithanasis & Michalakelis, 2018).

3.10.7 Security issues

Cloud security issues have been widely researched and debated but remain a thorny issue in as far as cloud computing adoption is concerned (Adane et al., 2019; Changchit & Chuchuen, 2018; Karadağ, 2016; Widyastuti & Irwansyah, 2018). SMEs are still concerned about the lack of security on the cloud. There is still some debate, contradictions and no consensus on cloud security issues. Some research shows that Internet-connected services are insecure (Changchit & Chuchuen, 2018; Karadağ, 2016; Widyastuti & Irwansyah, 2018) and liable to cyberattacks. Other researchers argue that security threats and issues can be attended to in real-time in the cloud to address risks to customer data, thus making migrating to the cloud very secure (Lee, 2019; Zaballos & Rodríguez, 2018). There is a need for cloud providers to vigorously market their products to allay such fears and consequently improve the adoption rate.

3.10.8 **Government regulations**

The government is expected to put in place regulations that promote the use of cloud computing. It has to provide the necessary infrastructure for Internet connectivity. The government should also draft regulations that protect organisations from unscrupulous cloud service providers. A good example is that of the Indian government that has put in place data protection and other regulations to encourage organisations to adopt cloud computing services (Widyastuti & Irwansyah, 2018). The government should be at the forefront, providing education and awareness of the benefits of adopting cloud computing to SMEs in particular and the whole of its citizenry in general.

Sections 4.5 and 4.6 discussed the benefits and barriers of the adoption of cloud computing, respectively. SMEs need to decide whether to adopt or not and make such important decisions, and they need Decision Support Systems (DSS). Decisions are difficult to make, especially in organisations where different people hold different beliefs and visions. In such situations, a DSS gives a starting point to help decision-makers distil and crystallise the problem to develop the best decisions to solve the problem. Pade-Khene and Lannon (2017) and Abdel-Basset, Mohamed, and Chang (2018) observe that a clearly defined, consistently applied approach and one that spans all organisational lines is the key to making better business decisions. The following section defines DSS and highlights some of the different DSSs found in the literature.

3.11 THE MIGRATION PROCESS

There is extensive literature on the benefits of cloud computing to SMEs. However, decisions to adopt cloud computing are complicated and still "marred by inconsistencies in the influence of a myriad of organisational, technological, environmental and human factors" (Lynn et al., 2018), which are contextual and situation-specific. Literature is also replete with well cited IT adoption models or frameworks, which can guide SMEs in adopting cloud computing (Lynn et al., 2018). The frameworks are fundamental because they itemise relevant decision-making variables and show how these variables interact to help the decision-makers arrive at the correct decision (Ray, 2016). However, it is essential to note that different environments are affected by different variables, that is, variables affecting IT adoption in one environment cannot be copied and pasted as they are on to a different environment. Besides shading light on important adoption issues, the framework helps organisations look into the mirror and ask tough questions about their readiness to adopt new technology. The above challenges show that SMEs' decisions to adopt cloud computing are complicated because many actors are involved in the adoption equation (Saedi & Iahad, 2013). It is a big decision to adopt cloud computing. Many loose ends should be tied together to decide whether to migrate to the cloud as such SMEs in Zimbabwe need some guidance by way of a framework to encourage them to adopt cloud computing. The literature review shows no cloud computing adoption frameworks in Zimbabwe that SMEs can use to adopt emerging technology. SMEs in Zimbabwe lack homegrown tools or frameworks to use as a guide to migrate to the cloud. This research will develop a framework that SMEs will use in Zimbabwe to adopt cloud computing. The framework will act as a guide to SMEs navigate the rugged ICT adoption terrain.

3.12 CONCLUSION

The chapter defined SMEs and looked at the characteristics of SMEs. The roles of SMEs as the backbone of the economy in any country have been espoused. The advent of technology has changed the way business is done. SMEs need to adopt technology to grow their businesses and remain competitive. Literature shows that there is a correlation between technology adoption and the economic growth of a country. Therefore, it is critical for SMEs and other organisations in Zimbabwe to embrace technology and improve the country's economy.

The chapter also highlighted the benefits of cloud computing adoption, which include increased competitiveness, flexibility, and cost savings. Regardless of the benefits, SMEs still experience barriers to adopting cloud computing. Some of these barriers include trust issues, security, vendor lock-in and poor Internet connection

SMEs in developing countries, indeed in Zimbabwe, still lag behind those in developed countries regarding the meaningful usage of ICT in their business processes. The literature reviewed shows that SMEs in Zimbabwe still face considerable challenges in adopting ICT like others in the developed world. The challenges include inadequate finances to invest in ICT, lack of skill and awareness, little or lack of government support, and inadequate infrastructure.

To increase the adoption of ICT by SMEs, Zimbabwe's government should open up the broadcasting space by inviting more service providers to enhance healthy competition. This competition is likely to lower the cost of data and likely improve Internet infrastructure in marginalised areas. The government should also incentivise SMEs by subsidising all ICT imports and offer tax rebates. The government can invite the private sector to set up ICT centres to increase ICT adoption and SMEs' use. Additionally, and very important is for the government to formulate SME friendly policies. Although many technology adoption models exist that can be used to determine predictors no evidence was found of frameworks that specifically assist SMEs in Zimbabwe to adopt cloud computing. This thesis will develop a framework that will help SMEs in Zimbabwe to adopt cloud computing. The next chapter is the second of the two literature review chapters for this study. The chapter highlights and discusses cloud computing as an emerging technology that SMEs can adopt in developing countries.

CHAPTER 4 LITERATURE REVIEW: THEORIES AND FRAMEWORKS OF CLOUD COMPUTING ADOPTION.

4.1 INTRODUCTION

The previous chapter discussed SMEs' importance, their characteristics and challenges they face in adopting the technology. This chapter reviews the adoption theories that have been widely used in technology adoption studies to answer sub-research questions two (SRQ2) and three (SRQ3) of this research. These sub-research questions are as follows:

SRQ2: What current cloud computing adoption frameworks exist that support strategic decision-making, and what are their shortcomings?

SRQ3: What are the main tasks and steps that SMEs should perform when making the strategic choice to adopt cloud computing as an ICT solution?

This chapter sets the study's theoretical foundation by reviewing the literature review to answer the following sub-research questions.

- Cloud computing adoption frameworks are answering SRQ2.
- Decision Support Systems (DSS) will answer SRQ3

The chapter gives some synopsis of these models; Diffusion of Innovation (DOI); Technology Acceptance Model (TAM); Technology Organisation Environment (TOE), and Theory of Planned Behaviour (TPB). The chapter will then discuss in more detail the two theories DOI and TOE that have been applied in this study and finally, the chapter presents a conceptual cloud adoption framework based on DOI and TOE from the literature review.

4.2 DECISION SUPPORT SYSTEMS (DSS)

The decision to adopt cloud computing is a complex process that requires intelligent information gathering, effort from everyone within the organisation, construction of a model, analysis and evaluation of alternative solutions (Alkhalil et al., 2017). A DSS is needed to help decision-makers to make informed decisions about cloud computing adoption. There are many different types of DSS, and consequently, there is no universally accepted definition of a DSS. Herein three definitions of a DSS are presented.

- Turban et al., (2005) define DSS as an interactive, flexible and adaptable computer-based information system developed to make better-informed decisions in proffering a solution of a non-structured management system.
- Sugiyarti et al. (2018) define DSS as a Computer-based System consisting of components, among others, component of the language system, component of knowledge system and problem processing system (problem processing) interacting one on the other.
- Aouadni and Rebai (2017) define DSS as model-based sets of procedures for processing data and judgments to assist a manager in his decision-making.

For this study, Aouadni and Rebai (2017) definition of a DSS will be adopted. It can be inferred from above that a DSS is structured and has a set of procedures that must be followed to arrive at a decision.

If used effectively, Decision Support Systems (DSSs) can help in decision-making in SMEs. The DSSs can use qualitative and quantitative data to present, compare, and rank potential alternatives and ultimately help decision-makers select the best decision or option to solve their problem (Jalaei, Jrade, & Nassiri, 2015). DSS are 'plugin' systems that can accept and use data, documents and knowledge models to produce output in the form of decisions that can solve users' problems (Wilson et al., 2015, p. 106). According to Jalaei et al. (2015), using a DSS improves decision-makers' efficiency, productivity and effectiveness. It can also facilitate the communication between different parties in an organisation and contribute to immediate problem-solving.

The decision-making process depends on the nature of the problem and the availability of resources to deal with the problem (Alkhalil et al., 2017). For DSSs to be useful, managers and decision-makers need to identify the problem, its magnitude and its implications to the organisation and the general market environment (Wilson et al., 2015). SMEs seeking to adopt cloud computing should be aware of the implications of such a decision both to the organisation and their market.

There is no one size fit all type of a DSS. Different situations will require different DSSs. From a large pool of DSSs, SMEs should select the most appropriate model that should fulfil their needs (Abdel-Basset et al., 2018). Table 4.1 below shows different types of well-known DSSs that SMEs can use during the decision-making process to adopt cloud computing.

Table 4-1: Review of some of the existing cloud DSS

Proposed Approach (DSS)	Cloud Service	Factors Taken into Account	Method	Level of Support
CloudCmp (Li et al., 2019)	IaaS	Cost, elastic computing, persistent storage, intra-cloud and wide-area networking	Comparative approach	Provider selection
Ranking and mapping of applications (Chan & Chieu, 2010)	IaaS	Physical properties and security, integrity and availability	SVD	Provider selection
Suitability for the adoption of cloud computing (Misra & Mondal, 2011)	Not specified	Size of IT resources, the utilisation pattern of the resources, the sensitivity of the data, and criticality of the service	ROI model	Design
CloudMIG {Frey, 2011 #414	PaaS and SaaS	Applications reengineering	Mathematical modelling	Design
Cloud adoption toolkit (Khajeh-Hosseini et al., 2012)	IaaS	Cost, characteristic social factors, political factors, performance, and practicalities	UML	Provider selection
DSS for migrating applications (Andrikopoulos, Darsow, Karastoyanova, & Leymann, 2014)(a)	SaaS	Applications distribution, cloud providers, elasticity strategy, multi-tenancy requirements.	Three-tiered architecture	Design and Provider selection
DSS for migrating applications (Andrikopoulos et al., 2014)(b)	SaaS	Cost and providers' characteristic	Conceptual modelling	Provider selection
Applications adaptations for cloud environment (Andrikopoulos et al., 2014)(c)	SaaS	The need for adaption	Holistic approach	Design
Partially migration of applications (Juan-Verdejo, Zschaler, Surajbali, Baars, & Kemper, 2014)	SaaS	Hybrid deployment	Component placement a and AHP	Design
SMICloud (Garg, Versteeg, & Buyya, 2013)	Not specified	Accountability, agility, assurance, cost performance, and security and privacy	Component placement a and AHP	Provider selection

SMICloud (Garg, Versteeg, & Buyya, 2013)	**Not specified**	**Accountability, agility, assurance, cost performance, and security and privacy**	**Component placement a and AHP**	**Provider selection**
InCLOUDer (Juan-Verdejo et al., 2014)	SaaS	Applications adaptations and Accountability, agility, assurance, performance, and security and privacy	AHP	Design
DSS for migrating applications (Strauch et al., 2014)	SaaS, PaaS	The database layer of an application	Step-by-step methodology	Design
CloudGenius (Menzel, Ranjan, Wang, Khan, & Chen, 2014)	IaaS	Cost, performance, providers' characteristic	AHP and mathematical modelling	Provider selection
Configuration support (García-Galán, Trinidad, Rana, & Ruiz-Cortes, 2016)	IaaS	Cost and providers' characteristic	Feature model	Provider selection
Workflow Infrastructure migration (Sáez et al., 2015)	IaaS	Cost and providers' characteristic	OPAL simulation	Provider selection

Source: Adopted from Alkhalil et al. (2017).

The above table shows some of DSSs that can help decision-makers make informed decisions in different situations. Each DSS model is situation-specific, uses a specific method, and takes a specific set of factors during the decision-making process. For example, the Workflow Infrastructure Migration model (Sáez et al., 2015) can be applied to the IaaS cloud and consider two factors, cost and providers' characteristics. This model uses OPAL simulation to help organisations to select a cloud service provider who meets their needs.

All the DSSs shown in Table 4.1 above and many other DSSs can, according to (Andrikopoulos et al., 2014) be classified into five categories which are: Data-driven DSS; Document driven DSS; Model-driven DSS; Communication driven DSS and Knowledge-driven DSS. The details of each of the decision support systems are beyond the scope of this thesis.

Regardless of the name and where it is applied, a DSS should exhibit at least four essential components: problem identification, designing the solution, making the best choice, and finally, implementation.

Based on the DSS definitions by Aouadni and Rebai (2017) that a DSS is a model-based set of procedures for processing data and judgements to assist a manager in decision making, the following section presents a structured model with a set of procedures that must be taken during a decision-making process to adopt a technology. The DSS is an eight-point model proposed by Drucker (2018). The eight points are highlighted below.

- **Identification of Problem**

The first step is to identify the problem that needs to be solved within the organisation.

- **Diagnosis of the Problem**

The next step would be to seek to determine what is causing the problem. It is imperative to diagnose the correct cause; otherwise, people will prescribe a solution to the wrong problem.

- **Collection of Information**

The next step would be to research the problem from many sources to understand the problem in greater detail thoroughly.

- **Developing Alternative Solutions**

This is an open brainstorming session where all alternative solutions or ideas are tossed. Creativity plays an integral part at this stage.

- **Evaluating Alternative Courses**

Each alternative solution is discussed; advantages and disadvantages are highlighted. The solutions must be evaluated against the objectives of the decision making and goals of the organisation.

- **Selection of the Best Alternative**

In this stage, the alternative solution that best fits the organisation's objectives and goals is accepted and adopted.

- **Implementing the Decision**

At this stage, everyone is put on board to implement the decision.

- **Feedback**

After implementation, the next step is to evaluate the results of the system. All stakeholders should give some feedback as to whether the decisions are bringing in the desired results. Both strong and weak areas must be noted. A decision should also be made whether to continue or discontinue with the decision.

The above steps show that the decision-making process should not just rely on intuition but also on structured, systematic decision support systems (Alkhalil et al., 2017). As already mentioned above, there are many DSSs that help to simplify the decision-making process. Each support system aims to simplify a problem and outline alternative courses of action to take and potential risks (Alkhalil et al., 2017). The DSS may not proffer the exact solution to the problem but provides recommendations on how the problem can be solved. DSS should provide the means to complement, strengthen and support the decision maker's judgement and personal intuition to make the correct decision to solve the problem at hand (Rashidi, Ghodrat, Samali, & Mohammadi, 2018). However, using DSSs has its challenges. For example, there may be a lack of strong internal leadership to drive the organisation's needed changes. The section below extolls some of the paradoxes and complexities associated with using DSSs within an organisation.

4.3 THE COMPLEXITY OF DECISION MAKING TO ADOPT CLOUD COMPUTING

Organisations are overwhelmed with too much information and clutter. To sieve through that clutter and get the relevant information, especially to the resource-starved SMEs. According to Alkhalil et al. (2017), the decision to adopt cloud computing requires a clear understanding of the cloud environment, proper and careful planning, analysis of the current system and ensuring that cloud computing will be compatible with the requirements of the organisations.

Decisions to migrate to cloud computing are tricky because there are many factors to consider, and difficult to select the best DSS from an array of diverse DSSs. More so, the contemporary environment is replete with wicked problems that are scattered, unstructured, and sometimes conflicting and pose a challenge to any efforts in designing DSS (Thuan et al., 2016). According to Pretorius (2017), a wicked problem is a class of ill-formulated problems, where the information is confusing, where decision-makers within an organisation hold conflicting visions about the organisation and everything in the whole system is confusing. The wicked problems are elastic, continuously metamorphosing; they are unstable and ambiguous in nature (Pretorius, 2017). Such problems can frustrate both individuals and organisations that encounter them. Examples of wicked problems include IT policy development, information system design, developing a cloud computing adoption framework and corporate strategy development and refinement (Pretorius, 2017). A good DSS should be multidimensional in nature to explore and interact with a wide range of wicked problems.

The other challenge is that many existing DSS are mostly conceptual or prototype-based (Alkhalil et al., 2017) and challenging to use them practically in real-life situations. Wilson et al. (2015) recommend that a good DSS model break down the task at hand into small manageable stages to give SMEs time to gather the correct information to make informed decisions before moving on to the next stage. This incremental approach to solving problems allows SMEs to reflect on the successes of the completed stage with an option to stop without losing the initial investments (Wilson et al., 2015). A good DSS model should help the decision-maker understand the length and breadth of the problem at hand and prepare ahead of time the tasks leading towards a solution (Wilson et al., 2015).

4.3.1 **Main tasks and steps to be taken during decision making to adopt cloud computing**

The section below details one of the DSSs in literature and highlights the main tasks and steps to be taken in a DSS model. The section answers sub-research question 3.

(SRQ3): What are the main tasks and steps that SMEs should perform when making the strategic choice to adopt cloud computing as an ICT solution**?**

The tasks and steps to be carried out when making a strategic choice to adopt cloud computing are shown in the generic model discussed below.

The DSS is termed a Generic Cloud Migration Model (Fahmideh & Beydoun, 2019). The model is very simplified and easy to follow.

4.3.1.1 *A Generic Cloud Migration Model (Fahmideh & Beydoun, 2019)*

It is a metamodel designed to help organisations plan and decide to move their legacy systems to the cloud. A metamodel is a model made up of many models (Fahmideh & Beydoun, 2019). Most DSS models in the literature are monomorphic compared to this polymorphic metamodel which draws its processes from various other models (Fahmideh & Beydoun, 2019). The model can be used as a DSS by SMEs to examine the extent to which key elements and processes are in place and then decide whether or not to migrate their legacy systems to the cloud (Fahmideh & Beydoun, 2019).

This model is not a cast in the stone model; it is flexible and situational; thus, any organisation at different levels of IT maturity can decide to migrate their legacy systems to the cloud. Furthermore, the model has easy to understand concepts to minimise multiple interpretations, it is simple in that it avoids unnecessary modelling details and can be applied to different migration scenarios (Fahmideh & Beydoun, 2019).

This model is made up of three phases (Figure 4.3) which are:

- Plan Phase
- Design Phase
- Enable Phase

Figure 4.3 shows how the three phases are connected.

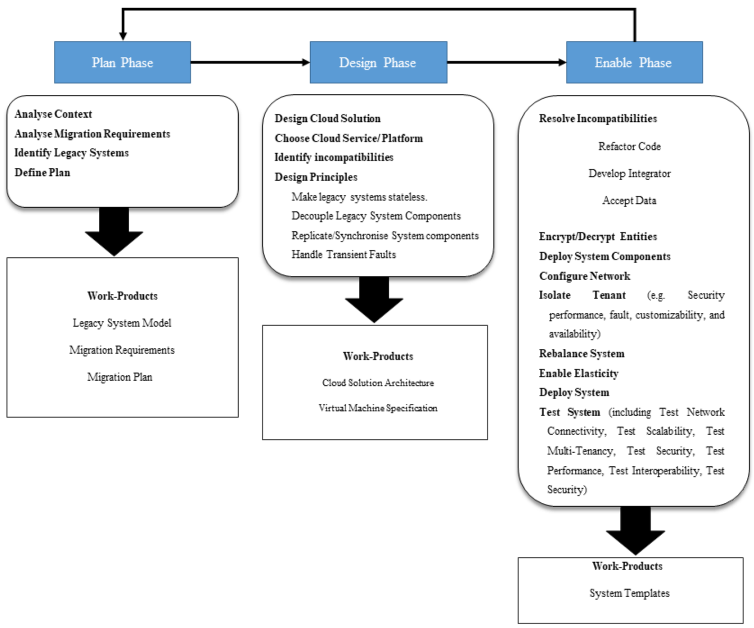

Figure 4-1: A Generic Cloud Migration Model (Source: Budiono, Lau, and Tibben (2018)

The section below briefly describes the three phases the make up this model.

4.3.1.2 *Plan Phase*

Cloud computing adoption is a technological improvement of legacy systems and entails a wide range of changes within the organisation (Fahmideh & Beydoun, 2019). Planning outlines the goals for migration and the impact that the changes will have on the organisation.

Figure 4.3 shows that Plan Phase is made up of four steps: analyse the context, analyse migration requirements, identify legacy requirements and define the plan. The four steps are described below:

- Analyse Context

This step entails in-depth analysis and understanding of the current system for smooth planning to adopt cloud computing. SMEs should analyse the impact of cloud computing on staff in terms of roles and expertise. Analyse Context step also justifies the choices of technologies and service providers chosen. Financial models should be used at this step to justify why the SME should move to the cloud.

- Identify Legacy Systems

It is essential to identify the legacy systems because the legacy systems are outdated and undocumented in some cases. All systems, functional and non-functional legacy system architectures are identified. After that, SMEs should identify and analyse functionalities, interactions and dependencies to other systems (Fahmideh & Beydoun, 2019).

- Analyse Migration Requirements

At this stage, SMEs must have clear goals and expectations as to why they need to migrate their legacy systems to the cloud. The SMEs should look at the migration requirements, which should include data storage, data security, response time, elasticity and should also estimate the required effort to move the legacy systems to the cloud (Fahmideh & Beydoun, 2019).

- Define Plan

All sequences and courses of activities during the migration process should be planned (Gholami, Daneshgar, Beydoun, & Rabhi, 2017). It is also vital at this stage to have a roll-back plan in case the process does not work as planned. Everyone within the organisation and all other stakeholders should be notified about the impending migration of a legacy system to the cloud.

The outputs of the Plan Phase are the legacy system model and migration requirements plan.

4.3.1.3 *Design Phase*

The Design Phase defines an appropriate cloud architecture for the legacy systems. As shown in figure 4.3, the phase is divided into four steps which are Design Cloud Solution, Choose Cloud Service/ Platform, Identify Incompatibilities and Design Principles. These steps are briefly described below.

- Design Cloud Solution

SMEs and indeed, many other organisations fear data security, privacy laws and network latency in the cloud environment (Gholami et al., 2017). To allay these fears, SMEs should decide on the processes to migrate and identify those that should remain with the legacy system. During the Design Cloud Solution stage, the legacy system processes are broken down and divided into small groups according to how they are related and how they interact. The other criteria to select what remains in the legacy system and what to migrate, as mentioned above, are data security, privacy laws and geographical location of the cloud servers (Fahmideh & Beydoun, 2019; Gholami et al., 2017).

- Choose Cloud Platform/ Provider

Several factors should be analysed when looking for a cloud service provider in the market. These factors include compliance of the service provider with regulations, support from the service providers, performance, pricing policies, data lock-in concerns, available architectures and models (Alkhalil et al., 2017; Fahmideh & Beydoun, 2019; Gholami et al., 2017).

- Identify incompatibilities

Migrating legacy systems to the cloud is challenging because "…cloud services are offered by different providers with different underlying technologies…" (Gholami et al., 2017, p. 108). In such cases, more so, that cloud computing has not yet reached maturity and that there are no standards in cloud services, incompatibilities are bound to happen. It is, therefore, essential to identify and resolve these incompatibilities. SMEs should investigate and check the capabilities of cloud service providers before they engage them. This is necessary because some cloud service providers have limitations; they cannot support specific applications, increasing the chances of incompatibility. For example, Azure has limitations in supporting Structured Query Language (SQL) functions (Gholami et al., 2017) and hence incompatibilities are bound to be experienced if the SQL database is run on Azure cloud.

- Design Principles

During the Cloud Design Cloud Solution stage, the legacy system processes are broken down, modified and redesigned. The process of modification and redesigning requires certain design principles to be followed to make the legacy system compatible with the cloud. The design principles that should be followed are Handle Transient Faults, Decoupling Legacy System components, make Legacy System Stateless, the Replicate Components and Synchronise Components. These design principles are briefly explained below.

- Handle Transient Faults Design Principle

The Handle Transient Faults design principle is about mechanisms that are put in place to detect faults when legacy systems are moved to the cloud.

- Decoupling Legacy System Components Design Principle

The decoupling design principle breaks down the legacy system into smaller stateless independent components that can run on their own (Gholami et al., 2017). This design principle has several advantages, for example, it is easier to identify a fault in a smaller component than in a considerable component and relatively easy to fix or reverse a small change in a small component than in a big one (Morris & Code, 2016). Gholami et al. (2017, p. 108) support this kind of design principle because it is crucial for "fault-tolerant when the system is run in the cloud."

To enable businesses' continuity at minimal downtime, the system components must be deployed over many different servers (Gholami et al., 2017). Such an arrangement in a cloud environment should support independent elastic scaling of components (Gholami et al., 2017), which is one of the advantages of moving legacy components to the cloud. The components should be synchronised to communicate with each other (Replicate Components and Synchronise Components).

4.3.1.4 *Enable Phase*

This phase is also known as the implementation phase. The architectural model designed in the Design Phase will be implemented. The modified legacy system processes will be interfaced with the cloud, and two significant steps must be fulfilled in this phase. The steps are to Resolve Incompatibilities and Encrypt and Decrypt. These steps are discussed below.

- Resolve incompatibilities

Incompatibilities identified during the Design Phase (modification phase) should be resolved. There are three types of modifications, Refactor Code, Develop Integrator and Adapt Data.

- The Refactor Code

The refactor code modifies legacy system codes, identifies and removes mismatches with the cloud service (Fahmideh & Beydoun, 2019; Gholami et al., 2017).

- Develop Integrator

Sometimes it is prudent to keep the legacy codes untouched and use an integrator, an abstraction layer that facilitates communication between the legacy system and the cloud (Fahmideh & Beydoun, 2019). The integrator helps to deal with incompatibility issues between the legacy systems and the cloud.

- Adapt Data

This involves some modification of legacy data so that it becomes compatible with the cloud.

- Encrypt and Decrypt

Code blocks of data that belong to SMEs must be secured first before being deployed to the cloud (Fahmideh & Beydoun, 2019). The step helps to secure the data. This is important to protect data from unauthorised access by other tenants who are running on the same cloud in a multi-tenancy cloud environment.

Finally, the last step in the Enable Phase is testing. The system has to undergo a lot of different tests. The tests that should be carried out are; test interoperability, test multi-tenancy, test network connectivity, test performance, test scalability, and security test. Table 4.2 below summarises vital elements to be considered when migrating legacy systems to the cloud.

Table 4-2: Key process concepts incorporated into the typical process of legacy system migration to the cloud.

Concept	**Definition**
Analyse migration requirements	Identify a set of requirements to be satisfied by the cloud, such as computational requirements, data storage, security, response time, and elasticity.
Define Plan	Define a sequence of tasks that guide the migration process by analysing feedback from stakeholders. A plan may include (i) notice of temporary unavailability of legacy systems, (ii) roll-back the system to in-house version (ii) migration type such as complete or partial and (iv) legacy system retirement procedures.
Recover legacy system knowledge	Produce a complete representation of legacy system architecture, including its data, components, dependencies among components and infrastructure, system data usage, and restore utilisation model (e.g., CPU, Network, and storage).
Recover legacy system knowledge	Produce a complete representation of legacy system architecture, including its data, components, dependencies among components and infrastructure, system data usage, and restore utilisation model (e.g., CPU, Network, and storage).
Choose cloud platform/provider.	Define a set of suitability criteria that characterise cloud providers' desirable features, including pricing model, constraints, offered QoS, electricity costs, power and cooling costs, organisation migration characteristics (migration goals and available budget), and system requirements.
Design cloud solution	Identify legacy system components concerning migration requirements and then define their distribution cloud servers.
Identify incompatibilities	Identify incompatibilities between legacy system components and cloud services.
Make system stateless	Enable the legacy system to handle the safety and traceability of tenant's session when various system instances hosted in the cloud.
Decouple system components	Decouple system components from each other. Use mediator and synchronisation mechanisms to manage the interaction between the loosely coupled components.
Replicate system components	Partition and deploy legacy system components (e.g., database and business logic) on multiple cloud servers.
Make mock migration	Build a new cloud solution prototype to understand how the system's functional and non-functional aspects will work in the cloud.
Use logging	Use logging mechanism to facilitate system debug and resource monitoring when running in the cloud.
Resolve licensing issues	Define and monitor a pay-as-you-go licensing model to handle unintended licence agreement violations due to automatic scaling.
Develop integrators	Develop mediators/wrappers to hide incompatibilities occurring at runtime between legacy system components and selected cloud services that are plugged to these system components.

Deploy system component	Install system components and any required third-party tools in the cloud.
Enable elasticity	Define scaling rules and provide support for dynamic acquisition and release of cloud resources.
Encrypt database	Encrypt critical databases before hosting in the cloud.
Handle transient faults	Detect and handle transient faults that may occur in the cloud.
Isolate tenant	Protect tenants' data, performance, and faults from other tenants, which are running on the same cloud server.
Encrypt/decrypt messages	Secure message transmission between the local components and those hosted in the cloud or distributed across multiple clouds using an encryption mechanism
Obfuscate codes	Protect unauthorised access to code blocks of components by other tenants running on the same cloud provider.
Reconfigure network	Reconfigure the system's running environment, including reachability policies to resources and network, connection to storages, setting ports and firewalls, and load balancer.
Synchronise/replicate system components	Provide support in the system to synchronise multiple components (e.g., database replica) hosted on-premise network and cloud servers.
Communicate a-synchronous	Enable application components to interact asynchronously.
Test system	Test system's security, interoperability, multi-tenancy, performance, scalability, and network connectivity of the system that migrated to the cloud.

Source: Fahmideh and Beydoun (2019)

This generic DSS model, as discussed earlier, is simple, flexible and can be used by any organisation to decide whether or not to migrate to the cloud. This model's downturn is too generic and may need to be refined and tailor to meet the needs of SMEs. A qualitative method was used to produce this model, and hence it is not easy to generalise any results churned out from this model.

One of the model's advantages is that it is not verbose, and it uses simple language, but much important information may be lost as a compromise between simplicity and detail (Abdel-Basset et al., 2018; Fahmideh & Beydoun, 2019)(Rocha et al., 2014). It is viewed as a great model because it combines both DSS and tools to aid in decision making during the migration process (Jalaei et al., 2015)(Rocha et al., 2014). Some scholars have criticised this model as being weak because it does not include the views of the cloud service providers and that it does not take into account the costs of software changes that may be required during migrating systems and process of an organisation to the cloud (Fahmideh & Beydoun, 2019)(Rocha et al., 2014). Furthermore, the model does not explain how the users can use the tools mentioned at each step in the model. Nevertheless, this model has all the ingredients to help SMEs decide to move their legacy systems to the cloud. After deciding to migrate a legacy system to the cloud, the next step is to plan the migration process. The next section describes the migration process and some of the IT and IS adoption models.

4.4 ADOPTION FRAMEWORKS

Many academics and IT consultancy agencies (Microsoft, Amazon, Oracle and many others) developed cloud adoption models to help SMEs and other big businesses to migrate to the cloud (Alkhalil et al., 2017). The only challenge with some of these models is that they are too generic and may not be portable in an environment different from which the model was developed. In addition, some of these models are closed proprietary and can only be distributed under licensing agreements and consultancy contracts to use them (Alkhalil et al., 2017). Furthermore, some models are developed for marketing purposes and married to certain types of hardware and software (Alkhalil et al., 2017).

Some of the IT and IS adoption models or frameworks that have been widely mentioned in literature are: Diffusion of Innovation (DOI); Technology Acceptance Model (TAM); Technology Organisation Environment (TOE); Theory of Planned Behaviour (TPB); Human Organisation Technology fit (HOT-fit), Cloud Computing Adoption Framework (CCAF), the Bass model and a host of other frameworks. This study, as discussed later in Section 4.13, will integrate DOI and TOE frameworks. The two models have been integrated and widely used in technology adoption studies (Palos-Sanchez, 2017; Stieninger et al., 2018). The two frameworks have been selected because variables from both frameworks are useful and relevant in adopting new technology (adoption of cloud computing by SMEs in Zimbabwe) (Palos-Sanchez, 2017).

Technology Acceptance Model (TAM) (Davis, 1989), the Bass model, the Theory of Planned Behaviour (TPB) (Ajzen, 1991), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) are classified as individual-level models because they are used to study what motivates an individual to adopt new technology. Diffusion of Innovation (DOI) Theory (Turner, 2007) and the Technology- Organisation-Environment Framework (TOE) (Tornatzky, Fleischer, & Chakrabarti, 1990) are referred to as organisational level models and thus are used to study how organisations adopt new technology.

The following frameworks: Theory of Planned Behaviour (TPB); TAM; DOI and TOE are explored below to understand how they relate to the adoption of cloud computing by SMEs. This section answers SRQ1 and SRQ2.

4.4.1 The Theory of Planned Behaviour

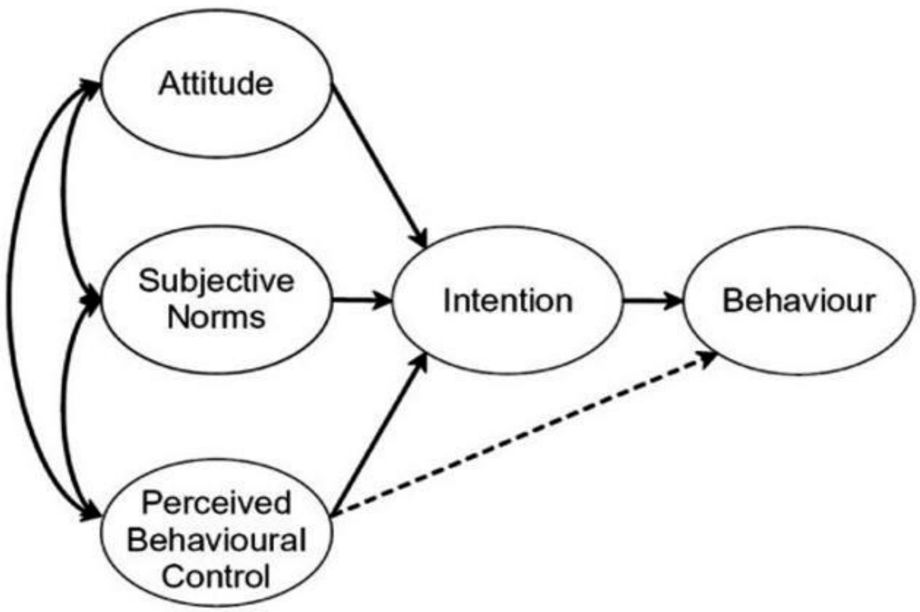

Figure 4-2: The Theory of Planned Behaviour (Ajzen, 1991).

The Theory of Planned Behaviour (TPB) (as shown in figure 4.4) is an extension of the Theory of Reasoned Action (TRA) by Fishbein (1980). It is one of the most cited and widely used theories to explain human behaviour (Olushola & Abiola, 2017; Sana'a, 2016). The theory has been applied to understand the customers' acceptance and use of different technologies (Olushola & Abiola, 2017).

According to Sana'a (2016), TPB assumes that customers make individual decisions by calculating and conducting the cost and benefit analysis, advantages and disadvantages of different courses of action and selecting the best fit. Thus, TPB contends that individuals have the power to make informed decisions to either engage or disengage in the behaviour of interest (Olushola & Abiola, 2017).

Human behaviour is complex, and it is affected by social and emotional factors (Taherdoost, 2018). The behaviour is collectively influenced by an individual's subjective norms, perceived behaviour control and attitude (Lai, 2017; Olushola & Abiola, 2017). The following section briefly describes the variables of the TPB.

4.4.1.1 *Perceived Behavioural Control*

This variable describes the extent to which an individual believes they have control over personal and external factors that may encourage or discourage their behavioural performance (Olushola & Abiola, 2017; Sana'a, 2016). Furthermore, individuals have the skills, resources and opportunities to control and influence their behaviour to adopt an innovation (Lai, 2017; Olushola & Abiola, 2017).

4.4.1.2 *Subjective Norms*

As individuals, we live collectively with other individuals as a society. Subjective norms refer to the pressure that is exerted on individuals by the society in which they live. According to Lai (2017), subjective norms refer to the community's attitude towards a particular behaviour. For example, this could mean that when some peer organisations (SMEs) have adopted an innovation, that can pressure those that have not yet adopted to follow suit.

4.4.1.3 *Attitude*

Attitude is the evaluation of an object based on beliefs about the object (Sana'a, 2016) towards the behaviour. It measures the degree to which a person has a negative or positive evaluation of their behaviour performance.

Al Maskari (2015) defines attitude as an individual's positive or negative feelings associated with performing a specific behaviour. TPB contends that the personality traits of an individual play an essential role to determine their behaviour.

The TPB has been extensively used in IS and IT areas to examine the users' acceptance, adoption, and use of IS systems and services in their individual capacity or for organisations they represent. du Buisson and Naidoo (2014) used TPB to study factors influencing IT workers' attitudes and intentions towards adopting green computing in

South Africa. Shalom, Israeli, Markovitzky, and Lipsitz (2015) applied TPB to study the use of cloud computing in an educational institution in Turkey. Shaikh, Glavee-Geo, and Karjaluoto (2015) used TPB to investigate the antecedents of the adoption of mobile banking services in the context of Pakistan, a developing country.

The manager or owner has a significant influence on decision making in SMEs because the decision-making process is usually centralised. The manager or owner's personality and perceptions affect their business decisions (Grandón & Ramírez-Correa, 2018). Therefore, personality influences the innovativeness of the manager or the owner. Research by Sana'a (2016) and Al Maskari (2015) show that attitude towards adopting cloud computing is a predictor of behavioural intention to adopt cloud computing. Studies by Grandón and Ramírez-Correa (2018) in Chile also confirm that manager attitude significantly affects technology adoption.

TPB has been integrated with other models in other studies to increase its predictive power (Kamau, 2017). TPB was integrated with TAM and DOI to investigate factors that influence eHealth services in Nigeria. In Kenya, TPB and TAM were used to investigate factors inhibiting the adoption of Internet banking (Kamau, 2017).

Despite having been so widely used, the TPB has been criticised for its lack of explanatory power to test different IS and IT contexts. According to Al Maskari (2015), TPB focuses on the social aspects of human intentions and completely ignores some organisational and environmental factors that can influence the intention to adopt the new technology. Human behaviour is very complex, but TBP simplifies human behaviour and focuses only on behaviours under a person's volitional control, that is, people are expected to exercise self-regulation over the behaviour they intend to exhibit (Ajzen, 2005, 2015). The next section discusses the Bass Model.

4.4.2 **The Bass Model**

The Bass model was proposed by Bass (1969) to explain the diffusion of innovation in retail service, industrial technology, agricultural, educational, pharmaceutical, and consumer durable goods markets (Wright and Charlett, 1995). According to Mahajan et al. (1990), the Bass Model assumes that potential adopters of an innovation are divided into two groups, the first group is influenced by communication-mass media (external influence) and the second by word of mouth (internal influence). Adopters influenced by communication-mass media are called "Innovators" and those influenced by word of mouth are called "Imitators" (Mahajan et al., 1990).

The Bass Model posits that the innovators independently adopt an innovation influenced solely by communicating with the media (external influence) and by novelty and characteristics of the product. The imitators are influenced by of the decisions of other people in a social system. The interaction between the innovators and the imitators directly influences the rate of adoption.

The figure below shows how an innovation is adopted using the Bass Model.

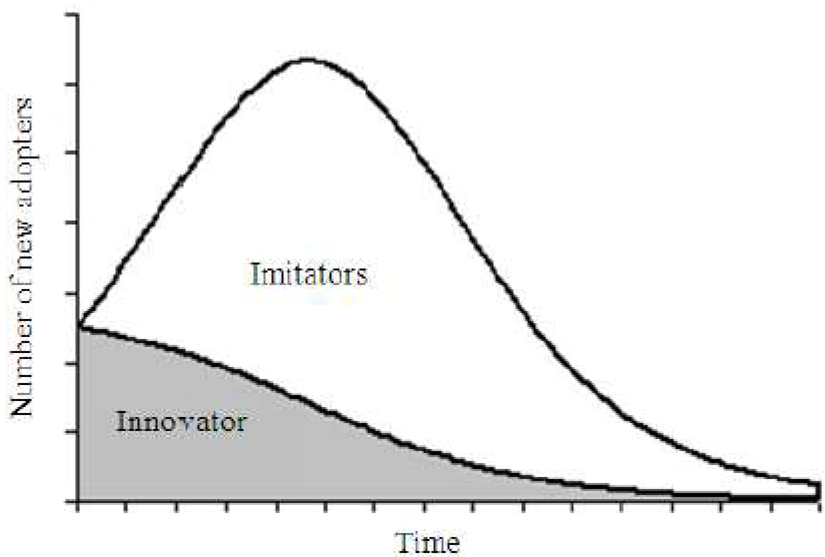

Figure 4-5a: The Bass Model (Bass, 1969)(Ajzen, 1991).

The above graph shows that when an innovation is introduced into the market, the number of innovators decreases as time goes on because there will be fewer potential innovators " (Mahajan et al., 1990). On the other hand, the number of imitators is zero at first, and then rapidly increases to reach a maximum point, due to the word-of-mouth communications from the innovators before it decreases. The word of mouth gives a strong influence on the imitators when more users adopt the innovation.

The Bass Model has been applied in many marketing research studies. Baur and Uriona, (2018) used the Bass model to develop a model of the German photovoltaic market for small plants on private houses. Kapur et al., (2019) used the Bass Model to develop a parsimonious and innovative model that captures the diffusion of a new product in high-technology markets. In another research Singhal et al., (2020) used Bass Model to examine the problem of stochasticity in predicting the adoption growth pattern of technological innovations.

Proponents of the Bass model argue that it is an analytical model for forecasting the first purchase of a new product category and has a very simple structure. The model suggests that diffusion of innovation is a two-step flow process, firstly through communication-mass media (external influence) and secondly by word of mouth (internal influence) (Mahajan et al., 1990; Wright and Charlett, 1995; Van den Bulte and Lilien 1997). The other advantage of the Bass Model, according to Moorthy (1993) and Van den Bulte and Lilien (1997:4) is that it is a mathematical model, which helps to "reduce the ambiguity inherent in verbal theories and facilitates the establishment of empirical generalization." The next section discusses the Technological Acceptance Model.

4.4.2 Technology Acceptance Model (TAM)

Davis proposed this model in 1989, and it is a robust and parsimonious framework that has been validated and has been widely used and accepted as a model for IT /IS adoption (Gangwar et al., 2015; Palos-Sanchez, 2017; Sana'a, 2016; Sharma, Al-Badi, Govindaluri, & Al-Kharusi, 2016; Z. Yang, Sun, Zhang, & Wang, 2015). Figure 4.5 shows a relationship between the acceptance of technology and its adoption. According to this model, perceived usefulness and perceived ease of use are two critical variables that affect the rate of technological adoption (Palos-Sanchez, 2017). In acceptance of new technology, users look at perceived usefulness and perceived ease of use (Sana'a, 2016).

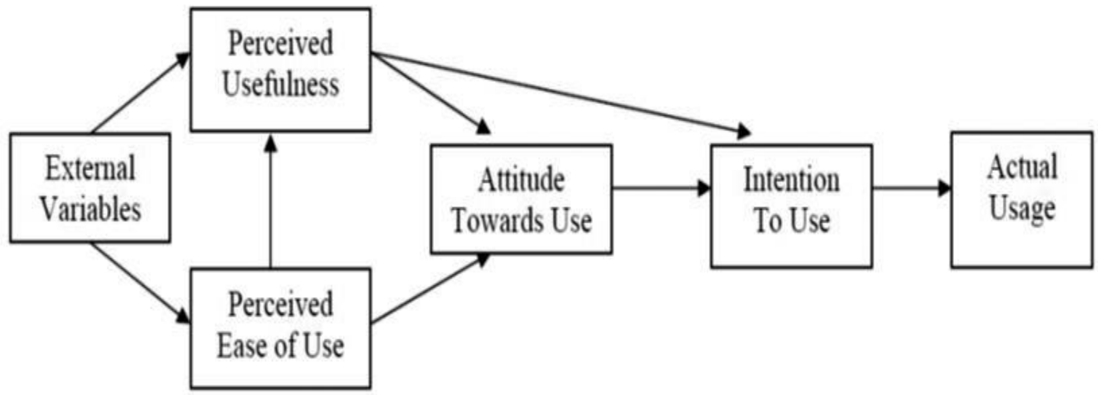

Figure 4-3: A first modified version of the Technology Acceptance Model (TAM) (Source: Davis (1989)).

According to the originator of this model, Davis (1989, p. 320) , perceived usefulness is the "degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort". Perceived ease of use evaluates the user's perception or belief that using a particular technology is effortless and one does not need to possess special skills to use new technology (Sana'a, 2016).

TAM has been extensively and widely used in research to understand how organisations adopt different technologies (Mayeh, Ramayah, & Mishra, 2016; Palos-Sanchez, 2017). The model has been used in ERP implementation studies in different industries (Mayeh et al., 2016). TAM has also been used in E-learning studies, mobile social gaming, Internet banking and other e-commerce technologies (Palos-Sanchez, 2017).

As a model, TAM focuses on an individual's behaviour towards adopting a technology (Alkhalil et al., 2017; Rohani, 2015). Perceived ease of use and perceived usefulness jointly determine an individual's behaviour to adopt a technology (Sana'a, 2016). TAM model assumes that an individual's decision to adopt new technology is solely voluntary, neglecting other contextual factors like peer pressure, new technology on the market or even new reporting requirements (Lynn et al., 2018). The model presumes that a person's intention to use technology will ultimately culminate in adopting and using it (Palos-

Sanchez, 2017). A good technology adoption model should not only focus on individuals but also contextual factors in which the individual or organisation operates.

TAM has evolved over time, and some studies have extended the original model by adding new variables to it, for example, TAM2 by Venkatesh and Davis (2000) and TAM3 by Venkatesh and Bala (2008). Sharma et al. (2016) extended TAM with three factors; trust, computer efficiency and job opportunity to propose how cloud computing can be adopted in an organisation. Although TAM has been widely used and well-validated in technology studies, it will not be used in this study. As already mentioned above, TAM focuses on an individual's behaviour towards adopting a technology (Alkhalil et al., 2017); hence it cannot be used in this study which aims to develop a framework that can be used by organisations to adopt cloud computing. The following section discusses the Diffusion of Innovation (DOI) framework. DOI is a framework that focuses on the adoption of technology by individuals.

4.4.3 **Diffusion of Innovation (DOI) framework**

DOI was proposed by Rogers in 1962 and was updated in 2003 (Palos-Sanchez, 2017), and it describes innovation as something (idea, practice, object) that is new to an organisation (Lynn et al., 2018).

According to Rohani (2015, p. 417), DOI is a "process in which an innovation is communicated through certain channels over time within a particular social system." The innovation is developed for a particular purpose which it must fulfil better than the predecessor (Palos-Sanchez, 2017). The channels used to communicate through an innovation usually target individuals and organisations. Thus, according to DOI, the channels used to diffuse the innovation will force individuals and organisations to adopt it. Through these channels, potential users acquire essential knowledge about the new technology and share their opinion with other potential users through certain communication channels(Idris et al., 2017; Sana'a, 2016). The diffusion rate of innovation depends on the characteristics of the innovation, how individual organisations view the technology and the types of channels through which it is spread (Palos-Sanchez, 2017; Rohani, 2015). DOI theory posits that what people perceive as benefits and the features of the innovation influence adoption decisions. The DOI, according to Amini and Bakri (2015), contends that adoption of an innovation depends on three factors which are individual characteristics (incorporating leadership's attitude towards change); organisational structure (number of employees) and external characteristics (system openness). DOI framework is used to study factors that affect technology adoption within organisations (Idris et al., 2017; Ilin, Ivetić, & Simić, 2017; Varma, 2019).

This framework is relevant to this study in many ways. DOI focuses on technological factors that influence the adoption of technology at an organisation level. This study seeks to develop a technology adoption framework that SMEs will use at an organisation level, thus making DOI very relevant. The following section describes the DOI decision-making process to explain the stages an organisation goes through before deciding to adopt cloud computing.

4.4.4 The DOI decision making process

Figure 4.6 below shows the stages of how technology adoption decisions are made within the DOI model.

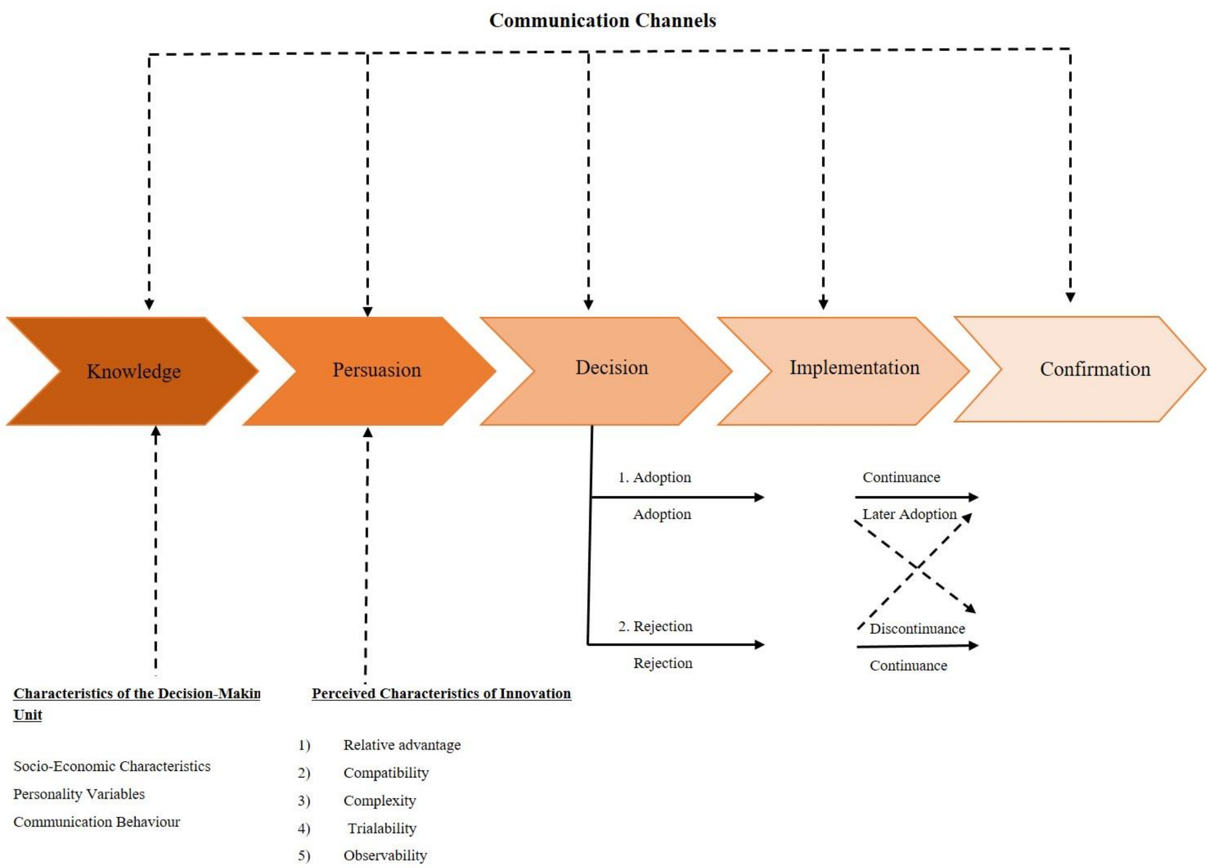

Figure 4-4: Conceptual model of innovation decision making process (Source: Turner (2007)).

Turner (2007) describes the innovation-decision process in individuals or organisations as a method to seek information about an innovation and understand its advantages and disadvantages. Figure 4.6 depicts the innovation decision making process. According to Turner (2007), the innovation-decision process involves five steps: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Rogers argues that the stages are sequential and should follow each other, as shown in figure 4.6. The stages are briefly described below.

4.4.4.1 *Knowledge stage*

This is the stage in which an individual or an organisation learns and seeks more information about the innovation, in this case, cloud computing. The individual or the organisation wants to know what cloud computing is and how it works (Hernández, Cano

Gómez, & Parra Meroño, 2017). This helps people to become aware of the existence of cloud computing. This awareness can motivate individuals or organisations to adopt cloud computing (Turner, 2007). After awareness, the individual becomes thirsty to acquire the how-to-knowledge, enabling users to understand how cloud computing works. Adopting cloud computing increases among SMEs if they possess the how-to knowledge (Miranda, Farias, de Araújo Schwartz, & de Almeida, 2016). The highest level of knowledge is known as knowledge principles, which explains how and why cloud computing works for SMEs. This type of knowledge is not useful for the adoption of cloud computing by individuals or SMEs. Turner (2007) notes that an innovation adopted without proper knowledge may be misused and ultimately discontinued. Some studies show that the owner's knowledge level and innovativeness play an essential role to adopt the technology (Chandra & Kumar, 2018; Palos-Sanchez, 2017; Sana'a, 2016).

4.4.4.2 *The Persuasion Stage*

The knowledge stage is more of cognition, while the persuasion stage is more of affection. Even if someone has all the necessary knowledge about cloud computing, the individual's attitude shapes the adoption or the rejection of cloud computing (Turner, 2007). Subjective evaluation from peers may affect an individual's opinion and belief about the new technology, leading to the adoption or outright rejection of the technology. Research shows that many SMEs owners/managers in developing countries consult their peers who have already adopted technology and help identify a potential vendor (Macharia, 2009; Sana'a, 2016). Any bad publicity from the peers may increase uncertainty levels, and at the same time, positive feedback from close friends or peers will decrease uncertainty levels (Grandón & Ramírez-Correa, 2018; Macharia, 2009; Palos-Sanchez, 2017). At this stage, an individual will evaluate the complexity, relative advantage and compatibility of the technology. The individuals can observe the technology in use at the neighbouring SMEs and hence can also arrange to try it at their SMEs. The cloud computing service providers may also come in handy to showcase their products through marketing.

4.4.4.3 *The Decision Stage*

Individuals will continue to search for new information to evaluate new technology. At this stage, and after having evaluated the technology, the individual can choose to adopt or reject the technology. If adopted, the individual can continue to use the technology or can decide to discontinue. The discontinuance decision may be that the innovation has failed to meet an individual's needs as was anticipated (Turner, 2007). If rejected, the individual can adopt it later after clearing all the uncertainties or can decide never to adopt it (Hernández et al., 2017). Unfortunately, in many SMEs in developing countries, the decision to adopt technology is usually made ad hoc by the owner or manager without consulting employees or other stakeholders (Grandón & Ramírez-Correa, 2018; Herselman, Wayi, & Ndiege, 2012). This is a big challenge because the one who makes decisions is not the implementer of the decisions. It means that the process is bound to fail if the owner decides to adopt without involving the employees, who, in most cases, are the implementers.

4.4.4.4 *The Implementation Stage*

The innovation is put into practice at this stage.

4.4.4.5 *The Confirmation Stage*

After the decision to adopt has already been made, the next thing is to look for support to back up their decision. Then, a confirmation step is taken to evaluate the positive and negative aspects of adoption and decide to continue adopting or discontinuing it (Miranda et al., 2016). At this stage, people need to be very careful because they may be exposed to different conflicting views about the innovation (Turner, 2007) and get confused about whether to continue or discontinue. Hence the attitude of an individual is very crucial at this stage.

4.5 RATE OF DIFFUSION OF INNOVATION

Turner (2007) describes the innovation-diffusion process as an uncertainty reduction process. When all the uncertainties or doubts have been levelled off, the innovation rate is likely to increase. The DOI model posits that five innovation characteristics can explain the rate of technology adoption at the organisational level: Compatibility; Complexity; Relative advantage; Observability and Trialability (Lynn et al., 2018). The DOI decision making process places the innovation characteristics of technology at the persuasion stage. According to Turner (2007), these characteristics can positively or negatively influence the adoption rate of technology. Figure 4.7 shows diagrammatically characteristics that affect the rate of technology adoption.

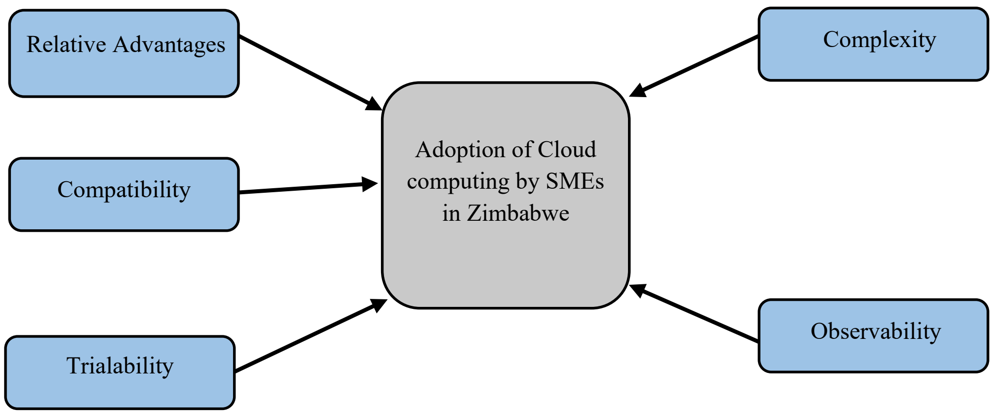

Figure 4-5: Factors affecting the diffusion rate of innovation (Rogers, 2003). Adopted from Sana'a (2016).

The following section briefly explains each of the five innovation characteristics related to cloud computing's adoption process as new technology.

4.5.1 **Compatibility**

The rate of cloud computing adoption is high if it fits nicely into an organisation's existing values and culture (Grandón & Ramírez-Correa, 2018). The cloud computing technology should be consistent with the user's current needs (Rohani, 2015) to be quickly adopted.

4.5.2 **Relative advantage**

This describes the extent to which cloud computing brings an advantage to an organisation (Amini & Bakri, 2015). Cloud computing adoption rate is accelerated when the management and their teams perceive cloud computing as being better than the systems and processes currently in use (Rohani, 2015). Studies by Chathurika (2019) and Oliveira et al. (2014) show that relative advantage positively affects IT adoption.

4.5.3 **Complexity**

Complexity refers to how easy or difficult the new technology, cloud computing, is to understand and use (Amini & Bakri, 2015). Some studies show that complexity can be a barrier to cloud computing adoption (Lynn et al., 2018; Rohani, 2015), especially if an organisation has some reservations about the new technology. Cloud computing is relatively new, and some organisations may doubt it (Rohani, 2015). Generally, more complex innovations have less chance of being diffused in society (Amini & Bakri, 2015; Rohani, 2015). According to Amini and Bakri (2015), if technology takes too much time and effort to learn, it is considered complicated.

4.5.4 **Observability**

Kee (2017) defines observability as how visible the positive results of new technology are to others in the social system. Therefore, to increase the adoption rate, the results of the use of cloud computing should be there for everyone to see and appreciate. Turner (2007) contends that the presence of visible and tangible equipment like computer hardware tended to be adopted faster than intangible programs like computer software. Observability can also be tangible when SMEs expand their market sphere, from local to global, and acquire new assets due to adopting new technology.

4.5.5 **Trialability**

According to Lynn et al. (2018), the adoption of an innovation is affected by the social system, an individual, organisation and external environment in which the technology has been used, greatly influencing the cloud computing adoption process. The technology should be available on a trial basis to give people and organisations time to evaluate it (Ray, 2016). Cloud computing service providers should allow SMEs to use their product for a certain period on a trial basis, after which the SMEs can decide to adopt or otherwise.

Based on the DOI framework, some studies show that complexity, compatibility and relative advantage are the three most important factors that influence the adoption of a technology (Boonsiritomachai, 2014; Hung, Huang, Lin, Chen, & Tarn, 2016; Lynn et al., 2018). Other studies reveal that relative advantage and compatibility play a more significant role to influence organisations to adopt new technology (Lynn et al., 2018). Yunis, El-Kassar, and Tarhini (2017) selected some of the DOI factors (i.e., compatibility, relative advantage, and trialability) to investigate the effect of these factors on the use of mobile banking through the consumer attitudes in Indonesia.

Kasse et al. (2015) used DOI to investigate the adoption of the Internet as an innovation in Uganda. The study concluded that compatibility, relative advantage and trialability predict the adoption of the Internet as an innovation in Uganda.

Sallehudin, Razak, and Ismail (2015) applied DOI to study factors influencing the adoption of cloud computing by public sector organisations in Malaysia. The sample used in the study comprised people working in the IT department and results show that comparative benefit, compatibility, and IT employee's knowledge affect cloud computing adoption in the Malaysian public sector.

Mkhize, Mtsweni, and Buthelezi (2016) used DOI to evaluate behavioural intent to use Learning Management System (LMS) based on relative advantage. The results show that both relative advantage and compatibility significantly affect students' attitude towards using the LMS. Surprisingly, unlike other studies, the results also reveal that complexity insignificantly impacts students' attitude towards using LMS.

Hosseini et al. (2016) carried out a study using DOI to investigate the Building Information Modelling (BIM) adoption within Australian Small and Medium-sized Enterprises (SMEs). The result shows that managers or owners' lack of knowledge and awareness on BIM is an insignificant barrier to BIM adoption for Australian SMEs. Their result contradicts Rodgers et al. (2015), whose results on a similar study point out that lack of knowledge and expertise on BIM is a significant barrier towards BIM adoption within the Australian construction industry.

Stieninger et al. (2018) used DOI to investigate factors influencing the organisational adoption of cloud computing among cloud users. The results show that compatibility, relative advantage, security, trust, and lower complexity level positively affect cloud computing adoption.

Due to rapid advancement and the ever-changing technological landscape, DOI framework on its own is inadequate to influence organisations to adopt the technology (Alkhalil et al., 2017). One of the limitations of DOI is that it assumes users have a free will to choose whether to adopt or reject the new technology and yet diffusion is both a conscious and unconscious social imitation among individuals and organisations (Kee).

According to Rohani and Che Hussin (2015) and Lynn et al. (2018), DOI focuses only on technological factors and ignores the environmental factors in which the organisation is situated. Some research shows that DOI focuses more on a product or innovation and excludes other factors that determine how a product is adopted and that it is weak at predicting individuals who want to adopt the technology(Amini & Bakri, 2015; Sana'a, 2016). Furthermore, Sana'a (2016) posit that DOI is more valuable in educational environments than in any other environment. As already discussed above, DOI focuses on technological factors that influence the adoption of technology by an organisation. These technological factors are relative advantage, the complexity of technology, compatibility of the technology to an organisation's IT infrastructure, observability and trialability. DOI framework is relevant to this study because, among other factors, this study seeks to establish the technological factors that influence cloud adoption by SMEs in Zimbabwe. Due to some weaknesses of the DOI framework (mentioned above), this study will be integrated with Technology Organisation Environment (TOE) framework (see Section 4.13 for reasons for the integration). The following section expounds on the TOE framework. The section discusses the TOE variables.

4.6 TOE FRAMEWORK

Tornatzky and Fleischer proposed this framework in 1990 (Lynn et al., 2018). According to the framework, factors that affect technology adoption can be diversely sorted into three contexts: technological, organisational, and environmental, as shown in figure 4.8. The three factors are briefly explained below.

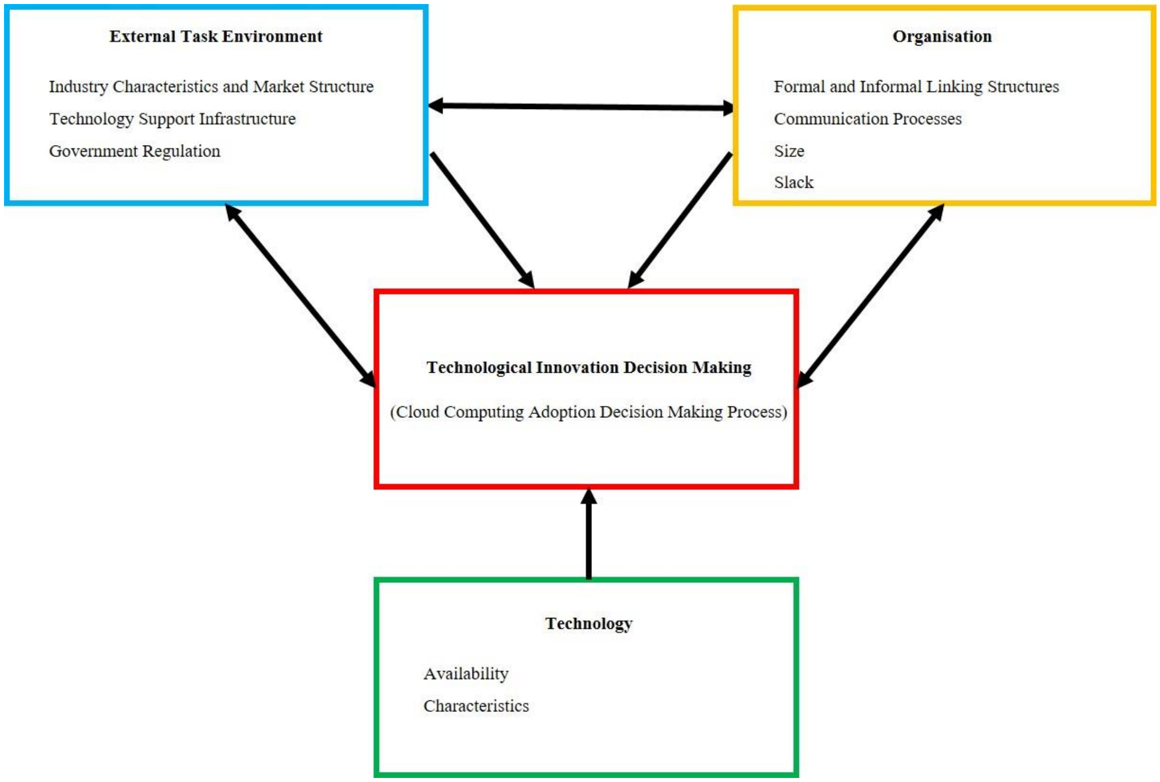

Figure 4-6: TOE framework (Source: Tornatzky et al. (1990)).

1.2.1 Technological factors

This refers to the internal technology currently being used in an organisation (Lynn et al., 2018). It also includes the available technology in the external environment. The internal technology influences cloud computing adoption because it determines the scope of disruptions that will happen when the organisation decides to adopt cloud computing (Harfoushi et al., 2016). According to Tornatzky et al. (1990), external technology can create incremental, synthetic or discontinuous changes within an organisation. Incremental technology offers new features to an already existing IT infrastructure (Amini & Bakri, 2015). Many organisations would prefer to implement incremental changes because they are less risky and do not drastically change their culture.

On the other hand, synthetic changes allow organisations to combine new innovation and 'existing technology in a novel way' (Amini & Bakri, 2015). Research shows that organisations that implement synthetic changes experience moderate risks (Al-Hujran et al., 2018; Amini & Bakri, 2015). Discontinuous changes are drastic and radically different from the technology currently in use in the organisation (Amini & Bakri, 2015). Discontinuous changes are disruptive, and they completely change the existing technology with a new one (Al-Hujran et al., 2018; Amini & Bakri, 2015). This is very risky, and organisations fret over these wholesome changes of the organisational culture. Organisations must be aware of these three types of changes to weigh each type's pros and cons and select the best according to their requirements.

The technological factors frequently mentioned in the literature include security, relative advantage, uncertainty, compatibility, complexity and trialability (Al-Hujran et al., 2018) (The factors have been discussed in Section 4.12 above). Adopting a new technology (cloud computing) is assumed to provide end-users with seamless services via the Internet anytime and everywhere. To increase the adoption rate, there should be a high quality of service, security, privacy, relative advantage, compatibility, trust, and trialability (Alkhater, Walters, & Wills, 2018). Some studies have shown that security issues, compatibility, relative advantage and privacy are among the barriers that inhibit companies from adopting cloud technology (Alkhater et al., 2018; Lal & Bharadwaj, 2016; Tang et al., 2016). Other studies cite perceived benefits as one of the significant drivers of cloud computing adoption in organisations (Hassan et al., 2017; Hsu & Lin, 2016). They argue that adopting new technology (like cloud computing) may increase internal and external business communications speed, increased efficiency in inter- organisation coordination creates better customer communications and satisfaction, and quick access to market information. This study seeks to establish how technological factors influence the adoption of cloud computing by SMEs in Zimbabwe.

4.6.1 Organisational factors

Organisational factors refer to an organisation's size, communication within the organisation, technology readiness, employee competencies, top management support and culture in and around the organisation. User's age and educational background are organisational factors (Martínez-Román & Romero, 2017; Sana'a, 2016). Organisational factors relate to the characteristics of an organisation that influence cloud adoption decisions. The organisational factors include firm size, top management support, communication and technological readiness, and discussion below.

4.6.1.1 *Firm size*

The number of employees determines an organisation's size, amount of investment, annual turnover, and to some extent, the target market (Palos-Sanchez, 2017)(Senarathna et al., 2018). Some studies have shown that firm size is an essential factor that affects the rate of adoption of a technology (Bhuyan & Dash, 2018; Gangwar et al., 2015; García-Moreno, García Moreno, Nájera-Sanchez, & de Pablos Heredero, 2018; Khalifa, 2016; Oliveira et al., 2014; Palos-Sanchez, 2017; Rohani, 2015; Senarathna et al., 2018). As a result, large firms have a large pool of resources and can cushion themselves from risks associated with adopting new technology like cloud computing (Rohani, 2015). On the other hand, SMEs have limited resources and are risk-averse to taking up new technology. However, some studies show that firm size does not influence the propensity to adopt new technology (Loukis, Arvanitis, & Kyriakou, 2017; Rahayu & Day, 2015).

4.6.1.2 *Top Management Support*

The top management plays a vital role in adopting new technology at the organisational level (Alkhater et al., 2018; Hassan et al., 2017). Support from top management is essential for executing change and adopting cloud technology in organisations (Oliveira et al., 2014; Rohani, 2015). Top management formulates the organisation's vision; therefore, their support, commitment and positive attitude towards change can accelerate the adoption of new technology (Yigitbasioglu, 2015). Several studies reveal top management is central to adopting cloud computing by an organisation (Alkhater et al., 2018; Hassan et al., 2017). The top management holds the key to the IT evolution and sophistication of an organisation (Rohani, 2015). Other studies argue that management's perception, attitude on IT, and IT knowledge are critical to SMEs' adoption process (Alkhater et al., 2018; Hassan et al., 2017; Oliveira et al., 2014; Rohani, 2015). However, some studies show that top management support is insignificant to IT adoption in an organisation (Palos-Sanchez, 2017; Z. Yang et al., 2015).

The inconsistency in top management in the adoption equation could mean that the studies were carried out in countries at different levels of economic development; hence, the definition and roles of top management are bound to be different. Interestingly, some studies have ranked an organisation's size as the most crucial factor to determine adoption, followed by top management support (Hung et al., 2016; Isma'ili, Li, Shen, & He, 2016).

4.6.1.3 *Communication*

The history of humankind shows that humans are creatures of habit if a method makes a job done, albeit inefficiently, they stick to it. The adage 'why fix it if it is not broken' aptly describes the inertia that humans suffer when it comes to organisational change. This is a barrier to cloud adoption, which is compounded by an incomplete understanding of the benefits of cloud computing (Gangwar et al., 2015). This barrier can be overcome through communication between the management and the employees in the organisation. The employees and other stakeholders should be informed and consulted prior to adoption so that their contributions are taken on board. Communication within an organisation is critical. It influences the adoption of innovation (Amini & Bakri, 2015).

4.6.1.4 *Technological Readiness*

Technological readiness is another essential organisational factor that influences the adoption of new technology. Technological readiness includes the current IT infrastructure and human resources base (Hassan et al., 2017; Palos-Sanchez, 2017). The current infrastructure provides a good platform for building cloud computing applications, and a rich human resources base should provide the necessary skills to implement cloud computing (Hung et al., 2016; Rohani, 2015). Evidence from the study conducted by Oliveira et al. (2014) indicates that firms with established technology infrastructure and competent workforce are better suited for cloud integration. However, Harfoushi et al. (2016) argue that technological readiness has no significant impact on influencing cloud adoption. They further argue that regardless of how endowed an organisation is with sophisticated hardware, software and expertise resources, the real nudge to adopt cloud computing comes from external factors.

Many organisations fail to adopt cloud computing because adoption initiative does not originate from the strategic level decision-making process (Harfoushi et al., 2016; Marr, 2019). Organisations should make sure that IT is at the core of strategic thinking and planning and should not be used to execute plans that were independently crafted (Coltman et al., 2015; Marr, 2019). It is imperative that organisations should realign their IS strategies with business strategies to remain competitive (Coltman et al., 2015). As a strategy and a way to build trust about cloud computing adoption, SMEs should start small and become confident in the small before adopting more services, a process called incremental progression (Coltman et al., 2015; Gangwar et al., 2015).

The management must have adequate information about the innovation, and similarly, the employees should also have some idea about the innovation to avoid employee resistance during the adoption period (Gangwar et al., 2015). Research shows that top management's innovativeness is significant in adopting innovation (Lynn et al., 2018; Rohani, 2015). Innovativeness means using new ways of doing things; decision-makers who are more innovative are more likely to adopt cloud computing (Hung et al., 2016). This study seeks to establish the organisational factors that influence cloud adoption by SMEs in Zimbabwe.

4.6.1.5 *Culture within the organisation*

Culture refers to the values, beliefs, norms and acceptable behavioural patterns within a family, organisation, community, and the nation at large (Azam and Quaddus, 2013). Fernandez-Jordan et al., (2020) describe organisational culture as a set of values, attitudes, and norms common and shared by members within an organisation. The culture within an organisation influences the behaviour of management and employees towards adopting new technology. The proliferation of technology and the knowledge-based economy have changed the way people live and communicate. For example, technology has transformed the customers' shopping and buying behaviour. To stay relevant and competitive SMEs must respond quickly and adapt to the technology disrupting the culture in the organisation.

The dynamism and cultural differences within nations or organisations can explain differences in perceptions of adopting technology (Lekhanya, 2013). Culture can be explained at different levels, for example, national, community, organisational and family levels. The national culture influences organisational culture, which in turn influences the top management, employees within the organisation and customers (Fernandez-Jordan et al., 2020). Cultural factors like individualism and uncertainty are critical elements in understanding why some organisations may or may not adopt the technology. A study by Gavin (2010) shows that an organisation's culture affects technology adoption in SMEs.

Several other studies show that the organisational culture that includes perceived values, norms, shared organisational vision and attitudes of owners and employees towards a new technology influence the adoption of that technology (Cameron and Quinn, 2011, Lekhanya, 2013; Zhang et al., 2021). The cultural environment plays a critical role in technology adoption (Lekhanya, 2013). In a study to show How Organisational Culture Influences the Use of Traditional, Digital, and Sharing Media in Korea, Ihm and Kim (2021) found out that organisations that practice democratic cultures in communication provided a comfortable environment for employees to share information and advice on how to use ICT regardless of work positions, lead to an active adoption of advanced technologies. However, this assertion is contradicted by Al- Shohaib et al., (2010) who, in a study to find factors influencing the adoption of the internet by organisations in Saudi Arabia, found out that organisations that practice authoritarian cultures values are more likely to adopt ICTs actively, its employees would not question the action by the management.

Given that adoption of ICT brings about enormous changes within the organisation, the management must support the vision by providing an enabling environment for the employees by allocating the necessary resources for the successful adoption of the technology. Furthermore, the management must offer training to the employees to overcome organisational resistance to change (Zhang et al., 2021). Training, coaching, and openness within the organisation may motivate the employees, thereby reducing uncertainty and ambiguity with adopting new technology in an organisation (Zhao et al., 2014).

The following section briefly describes environmental factors that affect cloud computing adoption.

4.6.2 **Environmental factors**

These include the environment in which the firm conducts its business, including competitors, communication with the government, geographical location, service providers and trading partners (Al-Hujran et al., 2018; Harfoushi et al., 2016). The environment in which the business operates is like water to fish, and the fish cannot survive out of water. In the same way, an organisation cannot survive outside the business environment. The environment has a significant impact on strategic decisions an organisation takes to survive (Ray, 2016). The section below explains briefly some of the environmental factors that affect cloud adoption.

4.6.2.1 *Competitive pressure*

It is the pressure experienced by the organisation from competitors engaged in the same line of trade (Al-Hujran et al., 2018). According toLynn et al. (2018) and Rohani (2015), competitive pressure will force organisations to adopt a new technology or innovation to remain viable and competitive. When competitors implement cloud computing as a competitive instrument, other organisations face intense competition; hence; feel pressure to adopt the cloud to maintain a competitive edge (Z. Yang et al., 2015). Cloud computing decreases costs and can increase operating efficiency (Harfoushi et al., 2016). On the contrary, in an earlier study by Alshamaila et al. (2013) on factors affecting cloud computing adoption by SMEs in North East England, competitive pressure was an insignificant factor in cloud adoption.

4.6.2.2 *Service provider relationship*

A good relationship with a cloud service provider increases the chances of cloud computing adoption. Some previous studies show a positive correlation between the service provider's marketing efforts and the organisation's adoption process (Hung et al., 2016; Rohani, 2015; Z. Yang et al., 2015). The intricate architecture of cloud computing requires tighter integration of all stakeholders; customers, business partners, and suppliers; thus, after-sale support is also needed to increase adoption chances.

SMEs should also be aware of the fine print on the Service Level Agreements (SLA). Some SLAs need to be understood well before cloud computing adoption. The service provider drafts the SLAs, and as such, the customer has not much said other than just appending their signatures on the dotted line. A study in Jordan by Al-Hujran et al. (2018) shows that SLA hinders cloud computing adoption because they are difficult to enforce and monitor, especially over vast geographical areas. The legal department of an organisation should thoroughly study the SLA to understand the terms and conditions before committing themselves. This is very important because some expensive exit clauses may force the SMEs to be 'locked in' the contract.

4.6.2.1 *Government support*

This is any support given by the government to promote the use of information technology in the firms (Lynn et al., 2018). The government should put in incentives, laws and regulations to promote and protect every firm that uses technology to conduct its business (Al-Hujran et al., 2018). Industry and government regulations can encourage or discourage the adoption of new technology. The government can help SMEs and other organisations by providing tax incentives and introducing regulations to force organisations to comply with some set-out technology standards (Albugmi, Alassafi, Walters, & Wills, 2016; Amini & Bakri, 2015; Isma'ili et al., 2016). There is still some debate on the effects of government regulations on technology adoption. In their study of cloud computing in Portugal, Oliveira et al. (2014) conclude that the regulatory framework has no significant impact on cloud computing adoption. On the other hand, some researchers believe that the impact of government on the innovation process is not clear (Amini & Bakri, 2015). This research will also seek to find out how government regulations in Zimbabwe affect SMEs' adoption of cloud computing.

As discussed above, the TOE framework focuses on the Technological, Environmental and Organisational aspects of cloud adoption by a firm. TOE has been widely used to determine how factors from the three contexts affect the adoption of technology in organisations. TOE describes how organisations adopt and implement the technology. The framework has been successfully applied in technology adoption within organisations. Rahayu and Day (2015) used TOE to examine factors that influence the adoption of technology by SMEs in Indonesia. In another study, Alkhater, Wills, and Walters (2014) used TOE to investigate cloud computing adoption by SMEs in Saudi Arabia. Senyo et al. (2016) investigated factors affecting cloud computing adoption by IT professionals and managers in Ghana. Previously reviewed research studies (Leung, Lo, Fong, & Law, 2015; Oliveira et al., 2014; Palacios-Marqués, Soto-Acosta, & Merigó, 2015; Tsou & Hsu, 2015) and many others show that TOE factors are found to be significant and positively influence innovation adoption decisions. Research shows that TOE is a reliable, stable framework that captures many variables that have been empirically tested to be valid and it has been widely used in several technology adoption studies (Al-Hujran et al., 2018; Idris et al., 2017; Isma'ili et al., 2016; Lai, 2017; Lynn et al., 2018; Rohani, 2015; Varma, 2019).

TOE model is said to malleable and can be customised to suit the environment it is going to be used (Isma'ili et al., 2016) because it takes into account a broader context (technological context, organisational context and environmental context) in which technology adoption process takes place (Isma'ili et al., 2016). The above discussion makes the TOE framework relevant to this study. The section below discusses some of the studies that have integrated the two frameworks DOI and TOE.

4.7 INTEGRATION OF MODELS

The dynamic growth of new technologies creates threats to established frameworks or IT adoption models (Lai, 2017). The 21st-century technological evolution and revolution require new adoption frameworks that are in tandem with the changing times. Organisations require contemporary frameworks to solve contemporary issues. The adoption models should address the needs of the customers today and not yesterday. The literature review shows that no previous study attempts to develop a cloud computing adoption framework for SMEs in Zimbabwe. This research seeks to develop a cloud computing framework that will guide SMEs in Zimbabwe to adopt cloud computing both as a technology and business strategy.

Technology adoption requires a more comprehensive framework that explains factors that influence an individual's decision to adopt technology and includes other contextual factors that affect adoption. Some studies argue that combining or integrating two or more models is vital to get the best outcome from the combination. Abdul Hameed and Arachchilage (2017) argue that integrating models helps complement each other, strengthening the proposed model's analytical ability.

Integrating DOI with TAM or TOE is a common approach used because TOE or TAM compensates for what is lacking in DOI (Palos-Sanchez, 2017; Z. Yang et al., 2015). The three models are tried and tested, robust, and widely accepted in IS adoption (Palos-Sanchez, 2017). Some of the adoption frameworks from literature are an integration of TOE and DOI (Abualrob & Kang, 2016; Alshamaila et al., 2013; Gide & Sandu, 2015; Hsu, Ray, & Li-Hsieh, 2014; Lynn et al., 2018; Oliveira et al., 2014; Osakwe, Chovancova, & Agu, 2016). Some studies have used a combination of TOE and TAM (Gangwar et al., 2015) and yet others combined TAM and DOI (Alkhalil et al., 2017; Lai, 2017; Rohani, 2015).

As mentioned earlier, each framework has its own advantages and disadvantages. DOI theory is strong on technological factors but weak on environmental and organisational factors (Alkhalil et al., 2017; Lynn et al., 2018; Rohani, 2015). It assumes that adopting technology is the prerogative of an individual rather than the social system (Palos-Sanchez, 2017; Stieninger et al., 2018). DOI ignores the fact that organisations are multi-layered systems with many teams that interact for the survival of an organisation. As such, decisions to adopt an innovation should be a collective, rather than individual, to reduce resistance from team members and instil a *for us-by-us* mentality in the organisation's members. Research shows that DOI as an innovation model focuses only on technological factors and ignores other important factors (environmental and organisation contexts) that determine how innovation can be adopted (Sana'a, 2016).

As a framework, TAM looks at what influences individuals' behaviour to adopt (Olushola & Abiola, 2017; Stieninger et al., 2018). TAM asserts that decisions to adopt an innovation (like cloud computing) in any organisation are made by individuals at the executive levels of organisations (Olushola & Abiola, 2017). Accordingly, TAM is a vital model to use to elicit responses from such individuals in an organisation.

TOE is an organisational level-based framework; it captures many variables that influence IT adoption at the organisational level (Alomar & de Visscher, 2017; Chandra & Kumar, 2018). It focuses on technological, environmental and organisational aspects. Rahayu and Day (2017) opined that TOE provides a better explanation of the technology adoption process since it covers many dimensions, unlike other models like DOI that cover only one dimension. Some studies argue that TOE is the bedrock upon which all other frameworks lie (Al-Hujran et al., 2018; Chiu et al., 2017; Oliveira et al., 2014). However, other studies show that TOE does not include individuals as promoters of ideas to adopt an innovation in an organization (Amini & Bakri, 2015; Rahayu & Day, 2017; Sana'a, 2016) and yet SMEs have the owner and top management as the same person who makes day to day decision about how to run the firm (Varma, 2019).

Based on the above discussions, it is challenging to select the best model from these many models. Both TAM and DOI are premised on the adoption of technology is based on the perception of the adopters and characteristics of the technology (Palos-Sanchez, 2017; Stieninger et al., 2018). Adopters will adopt cloud computing based on perceived ease of use (PEOU) and perceived usefulness (PU). Some of the variables from these models strikingly fit together, for example, PEOU constructs in TAM and technological complexity in DOI fit in together very closely (Olushola & Abiola, 2017; Stieninger et al., 2018).

Both TAM and DOI frameworks have been criticised for excluding influences of organisational and environmental factors (Alkhalil et al., 2017; Lai, 2017; Rohani, 2015). Therefore, integrating DOI and TOE will produce a hybrid framework with dominant features of both frameworks.

The fact that there is no single unified model that SMEs can use to adopt a technology means that researchers are left to their vices to develop tailor-made models to suit the needs of different SMEs in different contextual settings. Therefore, the purpose of this research, as alluded to earlier, is to develop a cloud adoption framework to assist SMEs in Zimbabwe to migrate to the cloud. To achieve this purpose, the study will use DOI and TOE frameworks as their theoretical foundation. Therefore, the research survey instrument is designed using variables from DOI and TOE models.

DOI and TOE are robust, tried and tested frameworks, as already discussed above. Previous studies have proven that the two frameworks' variables are useful and relevant in adopting new technology (Palos-Sanchez, 2017). DOI and TOE are commonly used together to explain the adoption of technology by an organisation (Oliveira et al., 2014). Piaralal, Nair, Yahya, and Karim (2015) posit that integrating DOI and TOE provides a useful framework for SMEs to adopt green technology. DOI and TOE have standard variables; in fact, all five attributes in DOI are subsumed in the TOE framework (Gide & Sandu, 2015). DOI helps to understand SME owners' attitudes towards cloud computing adoption. The two models complement each other very well in that DOI captures the users' perception and technological factors affecting the adoption of technology by an individual.

In contrast, TOE captures technological, organisational and environmental factors that affect the adoption of technology by an organisation. Furthermore, TOE identifies relevant adoption categories at a macro level while DOI helps to identify at micro-level specific variables in each category (in TOE)(Alkhalil et al., 2017). Numerous studies have used the two frameworks to explain cloud computing adoption in SMEs (Abualrob & Kang, 2016; Gide & Sandu, 2015; Hsu et al., 2014; Lynn et al., 2018; Oliveira et al., 2014; Osakwe et al., 2016).

Oliveira et al. (2014) combined DOI and TOE to study key factors that affect cloud computing adoption in Portugal's service and manufacturing industries. The study concluded that technology readiness, relative advantage, innovation, and complexity are technological context factors that affect the adoption of technology by Portugal's two sectors. The study found out that firm size and top management support positively influence the adoption of new technology in the organisational context. Competitive pressure and regulatory support were the two environmental context factors that encourage the adoption of technology.

Rohani (2015) integrated DOI and TOE to find the determinants of cloud computing adoption by Malaysian Universities Technology Transfer Offices (TTOs). The study found out that the four contexts: Human characteristics, technological, organisational and environment affect cloud computing adoption by TTOs in Malaysia.

Piaralal et al. (2015) integrated DOI and TOE in a study to understand factors that affect the adoption of green technology by SMEs. They conclude that integrating DOI and TOE provides a fundamental framework for SMEs to adopt green technology.

Gide and Sandu (2015) combined the two models to understand the key factors influencing cloud-based services adoption in Indian SMEs. Both DOI and TOE have been used to explain the determinants of cloud ERP adoption in Saudi Arabia (AlBar & Hoque, 2015).

Chiu et al. (2017) integrated TOE and DOI to study adopting a broadband mobile application by the enterprise. Combining more than one adoption model is very important because it clarifies how to adopt complicated technologies like cloud computing (Chiu et al., 2017).

Abdul Hameed and Arachchilage (2017) used DOI and TOE to study the organisational adoption process of new technology from the initial stage until acquiring a new technology area of study.

Senarathna et al. (2018) combined DOI and TOE to investigate factors that influence the adoption of cloud computing by SMEs in Australia. The results show that organisational factors, rather than risk-related factors, affect cloud computing adoption by SMEs in Australia. The following section explains why DOI and TOE will be used in this study.

4.8 APPLYING DOI AND TOE TO THIS RESEARCH TO DEVELOP A CLOUD COMPUTING FRAMEWORK FOR SMES IN ZIMBABWE.

DOI and TOE models are used to frame this study and will be applied as the theoretical foundation for this study. The two models, DOI and TOE, have been widely used in many other studies (Abdul Hameed & Arachchilage, 2017; AlBar & Hoque, 2015; Gide & Sandu, 2015; Oliveira et al., 2014; Palos-Sanchez, 2017; Piaralal et al., 2015; Varma, 2019)(Senarathna et al., 2018). Although the models are generic, the fact remains that they cannot just be used as they are (without any modification) in a setting that is different from which they were developed. This certainly is a barrier to understanding factors that affect the adoption of technology by SMEs, especially in developing countries like Zimbabwe.

The economic, social and political environment is different from the environments in which the two models were developed. It is not wise to adopt and use the two models and apply them without any modifications to understand factors affecting the adoption of cloud computing by SMEs in Zimbabwe. The models fail to explain the contextual characteristics that are unique to SMEs in Zimbabwe (Idris et al., 2017). Therefore, it is essential to review previous studies that used the two frameworks, DOI and TOE, to identify the variables and contextualise them to become relevant to cloud computing adoption for SMEs in Zimbabwe. The section below shows a conceptual cloud adoption model with variables obtained from previous DOI and TOE studies.

4.8.1 **Conceptual Adoption model from Literature review**

Based on the literature review, a model integrating DOI and TOE is presented in figure 4.9.

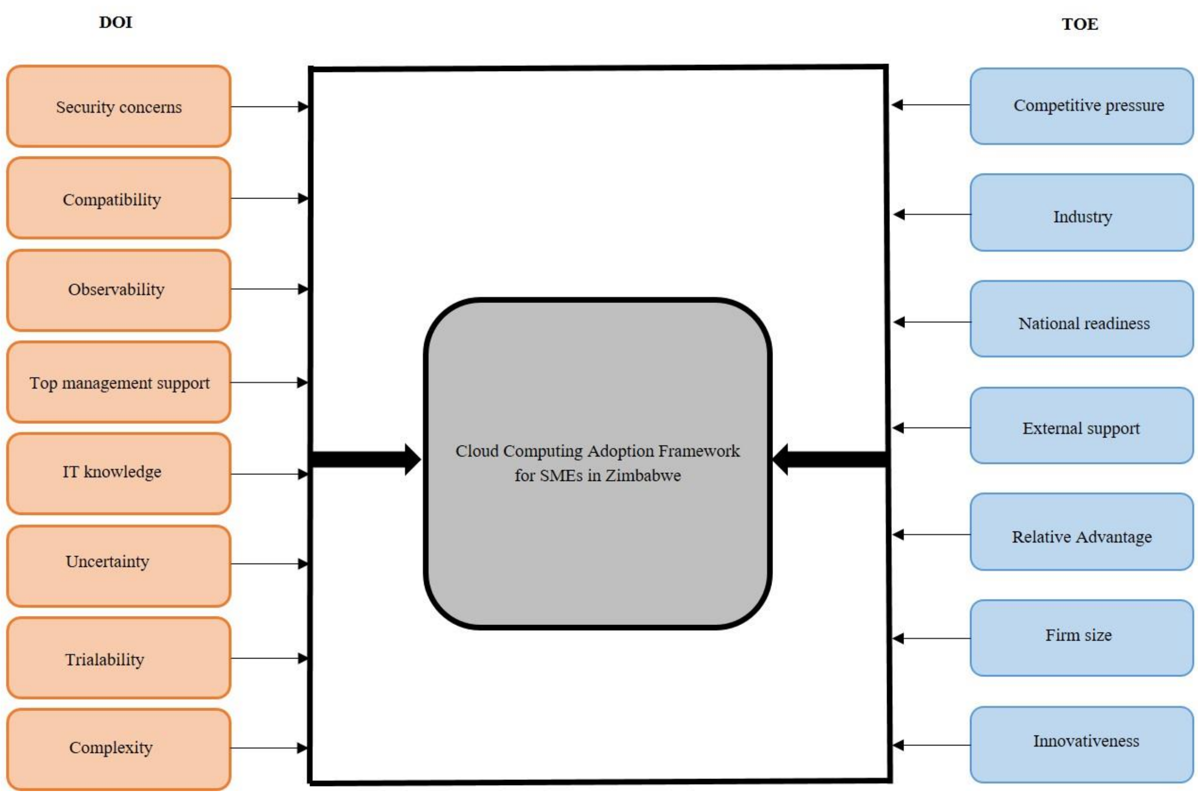

Figure 4-7: DOI and TOE factors affecting technology adoption (From Literature Review-Chapter 4).

Figure 4.9 above shows that fifteen factors from both DOI and TOE affecting cloud computing adoption have been identified. An in-depth literature review was conducted to identify these factors previously used in academic and industrial studies. These same factors are likely to affect the adoption of cloud computing by SMEs in Zimbabwe. The selected factors have been tested on many occasions in many academic studies, and their use in the cloud computing context by SMEs in Zimbabwe can be considered valid (Al-Hujran et al., 2018; Palos-Sanchez, 2017). Careful consideration has also been given to make these factors compatible with this study's objectives and the contextual characteristics of the SMEs in Zimbabwe. After a careful selection process, the factors were aggregated and classified as either technological, organisational or environmental, as shown in figure 4.10. The selected factors dovetail into the objectives of this study and the contextual setting of SMEs operating in Zimbabwe. Figure 4.10 shows how these factors were grouped.

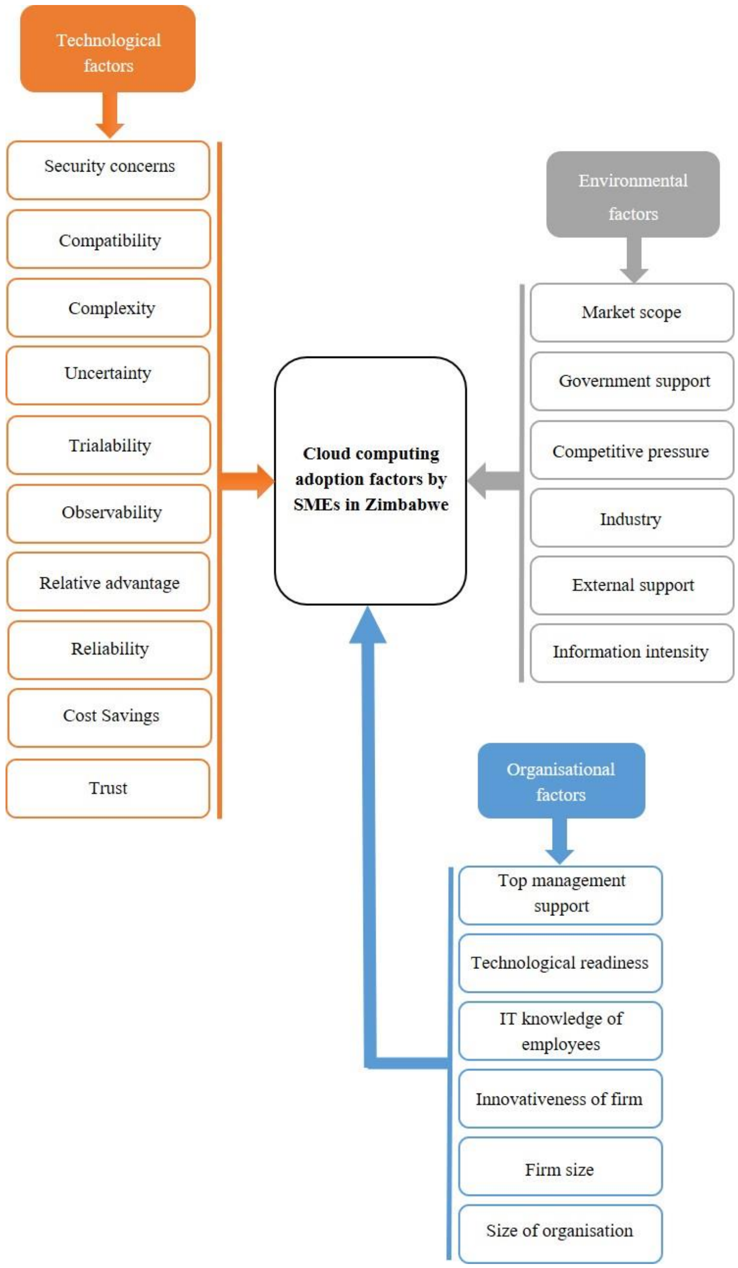

Figure 4-8: Conceptual cloud computing adoption model (Author)

The technical factors are extricated from the DOI model. These factors are compatibility, relative advantage, trialability, complexity and observability. The definitions of these terms are found in Section 4.12. Numerous studies have shown that relative advantage, compatibility and complexity are precursors to adopting new technology by any organisation (Al-Hujran et al., 2018; Amini & Bakri, 2015; Gangwar et al., 2015; Oliveira et al., 2014; Stieninger et al., 2018).

Observability as a technological factor is either not significant or is not widely used in technology adoption studies (Isma'ili et al., 2016). Regardless of its insignificance in other studies, this study will tap in and use observability as a technological factor to determine if it affects cloud adoption in Zimbabwe.

Security concerns have been classified as technological factors. Previous studies have shown that security concerns significantly affect technology adoption (Al-Hujran et al., 2018; Amini & Bakri, 2015; Gangwar et al., 2015; Kandil, Ragheb, Ragab, & Farouk, 2018; Stieninger et al., 2018; Widyastuti & Irwansyah, 2018). This study seeks to establish the extent of the influence of security in cloud adoption by SME in Zimbabwe.

The organisational factors are derived from the TOE model. As discussed earlier in Section 4.13.1, organisational factors are firm size, top management support, communication, innovativeness, technological readiness, IT knowledge of employees and level of education within an organisation. Previous studies show that firm size, top management support, and the firm's technological readiness are predicator to SMEs' adoption of cloud computing (Alkhater et al., 2018; Hung et al., 2016; Kandil et al., 2018; Yigitbasioglu, 2015). It will be interesting to see how these factors influence cloud computing adoption in this study.

The level of education and IT knowledge are significantly essential to influence cloud computing adoption (Chandra & Kumar, 2018; Grandón & Ramírez-Correa, 2018; Martínez-Román & Romero, 2017). The study by Olivari (2016) shows that SME managers and owners who possess high education levels are highly intrinsically motivated to adopt an innovation. Thus, this study will seek to establish the influence of the IT knowledge of employees in cloud adoption by SMEs in Zimbabwe.

Martínez-Román and Romero (2017) posit that the manager or owner's personal characteristics and the organisation's characteristic play an essential role in adopting the technology. The manager or owner is usually the one who makes adoption decisions in his or her SME. Kozubíková, Čepel, and Zlámalová (2018) advise that the SME manager or owner should have several personalities at once. The scholars suggest that the managers and owners should show the ability to act as an investor, leader, technologist, marketing specialist and inventor, among other skills. The more multi-skilled the manager or owner is, the easier it becomes to adopt new technology.

For comparison, Pofeldt (2014) suggests that the following are the most critical skills that the manager or owner of SME should possess vision, courage to take risks, creativity, leadership, integrity, honesty, flexibility, enthusiasm and passion. The results of a study by Olivari (2016) show that a manager or owner's personal characteristics help explain the firm's propensity to innovate.

It is essential to find out the effect of gender on the adoption equation. Some studies show that there are vast differences between male and female entrepreneurs in terms of their personalities to innovativeness. According to Goktan and Gupta (2015), males tend to be much more innovative, risk-takers, and very proactive in business than females. In another study on the influence of gender on adoption, Strohmeyer, Tonoyan, and Jennings (2017) reveal that firms led by females show a lower breadth and depth of innovation overall. The study shows that women are not very aggressive and thirsty to innovate.

In contrast to the above studies, other authors found that female entrepreneurs are more innovative than males (García-Moreno et al., 2018; García & Moreno, 2010; Pofeldt, 2014) and yet in another study by Jelenc, Pisapia, and Ivanušić (2015), it was found that there is no difference between the two genders when it comes to innovativeness and taking of risks. A more recent study by Bernardino, Santos, and Ribeiro (2018, p. 17) supports that both female and male social entrepreneurs are the same in matters of innovativeness, they 'have personalities characterised by high levels of openness to experience, agreeableness, conscientiousness, extraversion, and emotional stability.'

Based on the above assertions, there is no generally agreeable conclusion on the effects of gender on technology adoption. The reason could be that these studies were carried out in different settings, the structure of the society, gender disparity societies in terms of economic empowerment and different levels of economic development.

The environmental factors include the environment in which the SME is operating. In this study, the following factors will be considered as environmental factors: competitive pressure, service provider relationship and government support. Other environmental factors in the literature include national telecommunication infrastructure and type of industry (Kandil et al., 2018). Previous studies show that there are mixed results on environmental factors that affect the adoption of technology by organisations. In some studies, competitive pressure is regarded as insignificant (Alshamaila et al., 2013; Chandra & Kumar, 2018) in matters of technology adoption and yet in other studies, competitive pressure forces organisations to adapt and adopt new technology to survive the competition (Al-Hujran et al., 2018; Alkhalil et al., 2017; Gangwar et al., 2015; Harfoushi et al., 2016; Kandil et al., 2018; Rohani, 2015). It will be interesting to see how all these factors affect cloud computing adoption by SMEs in Zimbabwe.

4.9 CONCLUSION

In conclusion, this chapter discussed the benefits, barriers to adopting cloud computing by SMEs and some of the most influential IS adoption frameworks (TPB, TAM, DOI, TOE and the BASS model). The chapter also discussed the tasks and steps taken during the decision-making process. The chapter presented the initial conceptual adoption framework derived from integrating DOI and TOE frameworks from the literature review. The framework is a product of integrating DOI and TOE models. Integration helps to produce better frameworks that complement and compensate for each other's weaknesses. The next chapter will validate the initial conceptual adoption model through the use of interviews.

CHAPTER 5 QUALITATIVE DATA

5.1 INTRODUCTION

The previous chapter explored the literature review. The chapter highlighted different cloud adoption frameworks and factors that affect cloud adoption in SMEs. This chapter presents the findings and data analysis of the research's exploratory stage, Phase 2 of this study. This chapter represents Phase 2 (Phase 1 was a literature review) towards exploring and developing a framework for cloud adoption by SMEs in Zimbabwe and validating the initial cloud adoption framework from the literature review. DOI and TOE provided the theoretical foundations of this study.

This qualitative analysis was aimed to identify the influential factors in an organisation's decision to adopt cloud computing in Zimbabwe. In this exploratory phase, due to the geographical distance between Harare and Bulawayo and also due to some constraints (resources, COVID-19), telephonic interviews were conducted with decision-makers (owners, managers, CEOs) in 12 SMEs in Harare and Bulawayo (see Chapter 2).

5.2 THE PARTICIPATING SMES

Twelve SMEs participated in the interview. Six SMEs were purposefully sampled from each of the two cities (Harare and Bulawayo). Codes were assigned to the SMEs to protect their identities. Table 5.1 below highlights some background characteristics or profiles of the sampled SMEs. As shown in Table 5.1, the characteristics include Sector; Size (number of employees); Number of years in operation; Position of the interviewee and Market scope.

Table 5-1:The participating SMEs.

SME	Sector	Size (Number of Employees)	Number years in Operation	Position of the interviewee in the SME	Market Scope of SME
SME1	Carpentry and Wood Curving	9	3	Owner	Local
SME2	Construction	7	3	Manager	Local
SME3	Farming/ Agriculture	15	5	Manager	Local
SME4	Textile and Clothing	7	6	Owner	Local, National
SME5	Grocery/ Food Processing	5	2	Owner	Local
SME6	Mining	7	3	Owner	Local, National
SME7	Communication	3	2	Owner	Local, National
SME8	Manufacturing	13	9	Manager	Local, National
SME9	Finance	4	5	Owner	Local
SME10	Transport	20	6	Manager	Local, National
SME11	IT	3	2	Owner	Local
SME12	Pharmaceutical	2	2	Owner	Local

The participating SMEs were from diverse background and sectors. The majority, about 67% ($^{8}/_{12}$) of the interviewees, were owners, and about 33% ($^{3}/_{12}$) were managers.

5.3 QUALITATIVE ANALYSIS DESCRIPTION

The qualitative study was the second phase of this study which used purposefully selected SMEs deemed to be useful in answering the research questions. This part of the study aimed to identify the influential factors in an organisation's decision to adopt cloud computing. The interviews targeted decision-makers in the SMEs. These included managers, owners and chief executives of SMEs. These individuals were selected because they are likely to formulate policies, visions, and planning for adopting cloud computing in their SMEs.

The qualitative phase was used to evaluate the initial cloud adoption framework and gain better insights into the factors that influence SMEs' cloud computing adoption in Zimbabwe. Interviews have been used in many exploratory studies to gather interviewees' tacit and implicit knowledge (Astorga-Vargas, Flores-Rios, Licea-Sandoval, & Gonzalez-Navarro, 2017; Senarathna et al., 2018) about factors affecting their SMEs to adopt cloud computing. The interviews mostly used semi-structured questions and a few open-ended questions to encourage the participants to provide answers that reflected their attitudes towards the issues affecting cloud computing adoption in their organisations (Alsanea, 2015). Patton's (2003) qualitative interviewing strategies were used to improve the reliability of this part of the research.

Although all the participants were asked the same basic questions, the actual wordings were changed during the interviews to gain different perceptions about the subject under discussion. Each interview lasted between 25-30 minutes. The interviewees were assured that the data from the interviews would be anonymised. All interview sessions were audiotaped except for one manager, who declined to be audiotaped. The session lasted for about 45 minutes for that manager because notes were being scribbled during the interview process. The interviewees were informed that audio recordings were preferred to facilitate good accurate data mining and data analysis. To improve accuracy, the audio records were listened to several times and transcribed to a written language, and the transcripts were inspected for errors. The audiotapes were replayed and compared to the transcribed notes to avoid bias and validate the interview data. The transcribed notes were reviewed, and a summary sheet was created for each interview. The summary sheets were, in turn, reviewed to establish patterns and relationships (O. Ali, Soar, & Yong, 2015; Miles & Huberman, 1994). The data were then analysed manually using the Deductive Content Analysis procedure. The procedure is explained below.

5.2.1 **Deductive Content Analysis Procedure**

Deductive Content Analysis (DCA) was used in this study to analyse the collected data. According to Oates (2006), a DCA approach uses existing theories to categorise research data. A DCA is used when the study aims to test or extend the current or existing theory (Armat, Assarroudi, Rad, Sharifi, & Heydari, 2018; Hamad, Savundranayagam, Holmes, Kinsella, & Johnson, 2016). The DCA was selected to apply the DOI and TOE frameworks derived from the literature. DCA was explicitly used for data analysis in this phase of the study because it allows for the subjective interpretation of the interview data through a "systematic classification process of coding and identifying themes or patterns" (Freeman & Mubichi, 2017, p. 8). DCA is a more structured process that uses "previously formulated and theoretically derived categories" (Freeman & Mubichi, 2017, p. 7). Mayring (2015) describes the qualitative content analysis' approach as category-based, which fits nicely into this exploratory study which uses categories and themes framed from DOI and TOE theories.

Scholars like Schreier (2012) argue that the term deductive content analysis is misleading and would prefer to use the term *concept-driven* instead because the research will be using the already known concepts to classify the data. The categories, themes or theories are already predetermined in DOI and TOE frameworks. Thus, the researcher's role was to study the interview data, code the data and place it into appropriate categories or themes. Several studies have used this approach to analyse data (Armat et al., 2018; Freeman & Mubichi, 2017; Hamad et al., 2016).

This study phase sought to identify the influential factors that affect an organisation's decision to adopt cloud computing. The researcher listened to the recorded audiotapes several times to achieve this, and key themes and categories were identified. A transcription notation system was used to ensure consistency and clarity in the transcription (Braun & Clarke, 2013). Table 5.2 shows the transcription notation used in this research.

Table 5-2:Transcription notation.

Feature	Notation
Pausing	(.)
Non-verbal utterances	“err”
Spoken numbers	Spell out all numbers
Laughing, Coughing etc	((laughs)), ((coughs))
Identity of the speaker	The speaker’s pseudonym
Omitted words	(…)

This process was followed several times until the saturation point, at which no more new patterns or categories emerged. To avoid bias and to validate the interview data at this stage, the transcripts and summaries were sent back to participants through social media (WhatsApp) to verify. There were two minor adjustments from two participants, after which the coded words and phrases were placed into respective themes and categories based on the DOI and TOE frameworks. Tables were used to organise the themes and categories (see Table 5.3).

To identify and categorise factors affecting SMEs' cloud computing, the researcher prepared a list of categories and themes before data collection. The manually predefined categories and themes mentioned above were gleaned from DOI and TOE technological adoption frameworks from the literature review. If new categories that do not fit into pre-existing categories emerge, the researcher is advised to inductively create new categories (Armat et al., 2018; Mayring, 2014). Thus, any new category or theme that emerged during the interviews was put into a new group using this advice. Table 5.3 shows the categories and themes used in this study.

Table 5-3: Categories and themes from DOI and TOE frameworks.

Category	Theme
Technological Factors	Reliability of cloud computing
	Relative Advantage
	Compatibility
	Security Issues
	Complexity
	Cost Savings
	Trialability
	Uncertainty
	Trust
	Observability
Organisational Factors	Top Management Support
	Size of Organisation
	IT knowledge of employee
	Technological Readiness
	Innovativeness of the firm
	Age of firm
Environmental factors	Government regulations
	Competitive pressure
	Information Intensity
	External support
	Trading Partner Pressure
	Market scope
	Industry

5.3 FINDINGS AND DISCUSSIONS

After identifying the different categories and themes, the next step was to approach the sampled SMEs to understand the most influential factors in cloud computing adoption by SMEs in Zimbabwe. The participants were asked to agree or disagree with the extent to which each of the factors affects their organisation in adopting cloud computing. Agreeing would imply that the factor is significant, while disagreeing means the factor is insignificant

or less impactful. The results are presented below in the form of frequency and percentage tables. The letter (Y) denotes agreeing, and (X) means to disagree. The participants were also asked to explain why they agreed or disagreed with each of the discussed factors.

5.3.1 Technological Factors

The technological factors discussed in this study are shown in the table below.

Table 5-4: Technological factors.

Factors	SME												Frequency		Percentage (%)	
	1	2	3	4	5	6	7	8	9	10	11	12	Agree	Disagree	Agree	Disagree
Reliability	Y	X	Y	X	X	X	X	X	X	X	Y	X	3	9	25	75
Relative Advantage	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11	1	92	8
Compatibility	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12	0	100	0
Security	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12	0	100	0
Complexity	X	Y	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	10	2	83	17
Cost Savings	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y	Y	11	1	92	8
Trialability	X	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10	2	83	17
Uncertainty	X	X	Y	Y	X	X	X	Y	X	X	X	Y	4	8	33	87
Trust	Y	X	X	X	X	Y	Y	X	X	X	X	Y	3	9	25	75
Observability	X	X	X	X	X	Y	Y	Y	X	X	X	Y	4	8	33	87

From table 5.4, the following can be inferred:

5.3.1.1 *Reliability*

The majority (about 75%) of the respondents disagreed that reliability is an essential factor in cloud computing adoption. Reliability means the availability of the Internet connection whenever needed (Al-Hujran et al., 2018). To maintain customer confidence and satisfaction, cloud computing services providers should make sure that their services are available all the time. Based on the interview results, reliability did not seem to be an essential factor in cloud computing in this study. Some sentiments of the participants are recorded below.

SME4 stated that:

> *"reliability is one of our least worries for now what is needed is to have the necessary cloud computing adoption infrastructure in place, then afterwards, we start to worry about reliability."*

SME6 argued that:

> *"reliability is a small factor to us, and in fact, it is subsumed in other more important factors like security and compatibility."*

The results were quite surprising in that they contradicted many prior studies (Alshamaila et al., 2013; W. Kim, Kim, Lee, & Lee, 2009; Makiwa & Steyn, 2018; Sobragi, Maçada, & Oliveira, 2014; Widyastuti & Irwansyah, 2018) which confirmed that reliability was a significant factor in cloud computing adoption. This could be interpreted as the participants' limited understanding of the construct (factor).

5.3.1.1 *Relative advantage*

The findings revealed that the majority (92%) agreed that relative advantage is a significant factor in adopting cloud computing. Relative advantage means that cloud computing, when adopted, should perform better than the current system in use (Harfoushi et al., 2016).

SME2 observed that:

> *"...knowing the advantages of using something makes you want to use it."*

SME4 aptly summarised it well when he said:

> *"We can adopt cloud computing if it is better than the way we are currently doing things. If it is better than our current system, then we will be happy to try it."*

SME9 concurred and said:

> *"If relative advantage denotes the ease way of doing things, easy access to computing resources, then my organisation will be happy to adopt cloud computing within the next 12 months."*

The findings of this part of the research are not surprising as they are consistent with findings from prior ICT adoption studies (Chathurika, 2019; Kandil et al., 2018; Prause, 2019; Senyo et al., 2016) that confirmed the significance of relative advantage in the application of cloud adoption.

5.3.1.2 *Compatibility*

Based on the content analysis, 92% of the participants agreed that compatibility positively influenced SMEs' cloud adoption in Zimbabwe. Compatibility refers to the ability of the existing application or system to be compatible with the cloud (Alkhater et al., 2018). The results appeared to support that compatibility was a significant factor in applying cloud adoption by SMEs in Zimbabwe.

On the significance of compatibility in cloud computing, SME11inidcated that:

> *"We are ready to adopt cloud computing soon if it fits well in our current business infrastructure and processes."*

All other participants generally echoed the same thought, and SME8 added that:

> *"We are equipped with the latest technology, and we are ready to adopt cloud computing if the cloud computing platform is friendly to our IT platform we are using now."*

SME5 put it differently and stated that:

> *"We would use cloud computing if it is adaptable to the existing way of doing business, values and beliefs."*

The findings of this part of the study are consistent with many previous studies, for example, in Portugal (Oliveira et al., 2014); in Oman (Al-Shboul, 2018); in India (Gangwar et al., 2015) and in Saudi Arabia (Alkhater et al., 2014) that confirmed that compatibility has a significant impact on cloud computing adoption by SMEs.

5.3.1.3 *Security*

The findings showed that 100% of the participants agreed that security is an essential factor in determining cloud computing adoption. Security is about the vulnerabilities subjected to data in the cloud and the fear of third parties' attacks (Abubakar, 2016). Participants were fearful of allowing a third party to keep their sensitive data. The results revealed that security is a significant factor in cloud adoption by SMEs in Zimbabwe.

SMEs expressed similar sentiments, for example, SME6 retorted:

> *"It is difficult to hand over your data to a third party, especially in a public infrastructure in which the infrastructure is shared with other organisations, and in such cases, data vulnerabilities are bound to occur compromising the integrity of our data."*

Similarly, SME10 commented:

> *"Security of our data is a big issue to us; we want the service provider to store our data in our country so that if there is a breach of our data, we can use the laws of our country to seek remedies. It is difficult to seek redress if our data is stored off-shore in a different jurisdiction."*

The findings are consistent with previous studies that highlighted security as an essential factor in adopting an innovation. Skafi et al. (2020) found out that security is an essential factor influencing SMEs' adoption of cloud computing services in Lebanon. O. Ghazali et al. (2017), in their study of security measurements in the cloud, argue that security is an essential factor because it includes crucial issues such as data confidentiality, integrity, and audibility. These are a priority to any organisation. In another study in Ghana, Senyo et al. (2016) found that security to be an essential factor in cloud computing in Ghanaian SMEs.

5.3.1.4 *Complexity*

Based on content analysis, about 83% of the respondents agreed that complexity was a significant factor in SMEs' application of cloud adoption, while 17% disagreed. Complexity means that the technology should be comfortable to implement and use to increase the chances of its adoption (Skafi et al., 2020). Generally, when innovations are user friendly, they can be accepted quickly. The following are some comments made by some of the SMEs on the issue of security.

SME4 stated that:

> *"Generally, new technology is perceived as difficult or complex to use; this perception will, however, disappear when we get used to the technology."*

SME5 observed that:

> *"If people do not have experience in how to use cloud computing, they will look at it as a complex technology and would not adopt it even without trying it."*

SME11 suggested that:

> *"Cloud computing, to me, seems complex, I need training first to see how it operates, then I can decide to adopt it or not."*

SME9 concurred and said:

> *"I feel cloud computing is too complex, so I think I need more time and effort into training."*

This part of the study's findings is not surprising because they are consistent with previous studies highlighting complexity as a critical criterion of cloud adoption. A study by Chathurika (2019) found that complexity determines cloud adoption by SMEs in Sri Lanka. Kandil et al. (2018) also found out that complexity affects cloud computing adoption by SMEs in Egypt. Gutierrez, Boukrami, and Lumsden (2015) carried out a study on factors influencing managers' decisions to adopt cloud computing. Results show that complexity is one of the factors that influence cloud adoption by SMEs. In a study in Portugal, Oliveira et al. (2014) conclude that complexity is pivotal in adopting SMEs' cloud computing.

5.3.1.5 *Cost Savings*

The majority of the participants, about 92%, agreed that cost savings are an essential factor affecting SMEs' adoption of cloud computing. This part of the research shows that cost savings are critical factors affecting cloud computing adoption by SMEs in Zimbabwe. Some of the captured ideas about cost savings on cloud adoption are as follows.

SME1 commented:

> *"Given a chance, I would adopt cloud computing because setting it up is much more affordable than our traditional IT infrastructure."*

SME5 intimated:

> *"When we adopt cloud computing, we will not invest in IT departments, set up infrastructure or in people to maintain that infrastructure, even upgrading it when it becomes obsolete, thus reducing the cost incurred by our organisation."*

Importantly SME8 noted that:

> *"Indeed, it is true that cloud computing lowers operational costs because there will be no need to buy computers or software and there will be no maintenance costs, and there will even no need to worry about antiviruses as these will be provided by our service provider. For a small organisation like ours, this is very economical."*

While there are mixed results on the significance of cost savings on innovation adoption from previous studies (Prause, 2019; Skafi et al., 2020; Vidhyalakshmi & Kumar, 2016), the findings of this part of the study showed that cost savings positively impact cloud computing adoption by SMEs. The findings are consistent with results from previous studies (Gutierrez et al., 2015; Priyadarshinee, Raut, Jha, & Kamble, 2017; Vidhyalakshmi & Kumar, 2016). Research shows that adopting cloud computing lowers considerably upfront IT capital investments and operational expenses as organisations only pay for their use (Alshammari, 2019). Other studies by Skafi et al. (2020), Sandu and Gide (2019), Asadi, Nilashi, and Yadegaridehkordi (2017), Doherty, Carcary, and Conway (2015) and many more confirm those cost savings is a significant factor in cloud computing adoption.

However, some studies argue that the pro cost savings studies tend to be grounded on transaction cost reduction and return on investments without actual tests to show that indeed it is a vital factor to influence organisations to decide to adopt cloud computing (Arvanitis, Kyriakou, & Loukis, 2017; Ayong & Naidoo, 2019; Oliveira et al., 2014).

5.3.1.6 *Trialability*

The majority, about 83% of the respondents, agreed that trialability is an essential factor in deciding whether or not to adopt cloud computing, while only about 17% disagreed. Trialability helps SMEs test cloud computing technology in context on a limited basis (Skafi et al., 2020). This trial period will help SMEs to understand how the technology works and will also be able to evaluate whether it meets their needs. This part of the study showed that trialability is an essential factor in cloud computing adoption. Cloud computing is a new technology to most SMEs, and most of them are eager to test it in context before they fully adopt it. The following are comments about trialability from some of the SMEs.

SME5 observed:

> *"Testing cloud computing technology in our organisation for a prescribed period greatly affects our decision on whether to adopt it or otherwise. The trial period allows us to evaluate it."*

The same sentiments were echoed by, SME8 who commented:

> *"I think we need to try the cloud services before adopting the technology to understand how it functions and how well suited it is to our way of doing business."*

SME11 aptly summarised it:

> *"Experimenting with cloud computing temporarily reduces the perceived risks and fear in us as decision-makers to decide from an informed view of whether to adopt or not."*

Previous studies show inclusive findings of trialability as an essential factor in cloud computing adoption studies. This study's findings are consistent with prior studies (Alkhater et al., 2018; Emani et al., 2018; Isma'ili & Zahir, 2017; Johnson, Woolridge, Wang, & Bell, 2020; Walker & Brown, 2019), which confirm that trialability is an essential factor in cloud computing. However, some studies list trialability as an insignificant factor (Chathurika, 2019; Nasser & Jawad, 2019; Prause, 2019; Skafi et al., 2020) in cloud computing adoption.

5.3.1.7 *Uncertainty*

The findings from this part of the study showed that the majority, about 67% of the respondents, disagreed that uncertainty is a significant factor in cloud computing adoption. Uncertainty can be interpreted as the fears people have about using new technology (Skafi et al., 2020). Like other objects in nature, people suffer from inertia and resist change, especially when trying an innovation. This part of the study's findings shows that uncertainty is an insignificant factor in determining cloud computing adoption. Uncertainty issues are closely related to security issues, privacy and trust in technology and cloud service providers. The findings from this part of the study might reflect a lack of knowledge about this innovation. SME5 and SME6 summarise the views of the majority of the respondents. SME5 noted that:

> *"Uncertainty on its own is not a significant factor in our organisation, and this uncertainty is closely related to security concerns, the privacy of our data and trust of ceding our sensitive data to a third party. Once these issues are resolved, there is no uncertainty to talk about."*

SME6 observed that:

> *"Uncertainties arise because as SMEs, we may not be aware of the benefits because most of the time we tend to focus on the risks, thus*

> *focussing too much on the negative side instead of looking on the positive side. I think education and training may reduce uncertainties."*

Surprisingly the results of this part of the study contradict previous studies (Al-Lawati & Al-Badi, 2016; Alshammari, 2019; Isma'ili & Zahir, 2017; Senarathna et al., 2018; Senyo et al., 2016; Yeboah-Boateng & Essandoh, 2014), which confirm that uncertainty has a significant impact on cloud computing adoption.

5.3.1.8 *Trust*

Based on the content analysis of the findings, about 83% of the participants disagreed that trust is an essential factor to determine cloud computing adoption. Trust is a belief that cloud computing adoption would provide quality service and that the service providers would not renege on their contractual obligations (Al-Hujran et al., 2018). From the findings, trust appears to be an insignificant factor in SMEs' cloud computing adoption in Zimbabwe. The observations from the participants varied but could be summarised by SME2 and SME5, that had this to say; SME2:

> *"Trusting is not a big issue with us because we think it is subsumed in more important issues like privacy and security. If these important issues are addressed, then the issue of trust will also be addressed too."*

SME5:

> *"When I am assured that my data are secure, then I can trust the service provider."*

Previous studies that applied DOI and TOE adoption frameworks show mixed results on the impact of trust in the adoption of technology. Some studies suggest that trust is very significant in the adoption of an innovation (Ali, Soar, & Shrestha, 2018; Alkhater et al., 2018; Kandil et al., 2018; Sandu & Gide, 2019; Yeh, 2020) while others seem to contradict this (Hsu et al., 2014; Isma'ili et al., 2016; Kumar et al., 2017; Martins, Oliveira, Thomas, & Tomás, 2019; Matias & Hernandez, 2019; Senarathna, Yeoh, Warren, & Salzman, 2016). Alkhater et al. (2018) argue that trust is instead a broad construct and recommend that future studies should be broken up into smaller components like trust in technology, trust in service provider, trust in the quality of service, institutional trust and so on to give the respondents or participants in the study more degrees of freedom to understand and respond more accurately on this subject (trust).

5.3.1.9 *Observability*

The findings showed that about 67% of the participants did not find observability vital in cloud computing adoption. Only 33% found observability to be an essential factor in the adoption of cloud computing by SMEs. Observability means how visible the results of using an innovation are to other organisations (Chiu et al., 2017; Hsu & Lin, 2016). The findings showed that observability was an insignificant factor in cloud adoption by SMEs in Zimbabwe.

Unexpectedly, this research's findings are inconsistent with prior results in literature in which observability is found to be significant in cloud computing adoption (Chiu et al., 2017; Hsu & Lin, 2016; Sayginer & Ercan, 2020; Yeh, 2020). The unexpected result could be that the technology has not yet dominated or matured in the Zimbabwean market.

5.3.2 **The Organisational Factors**

The organisational factors discussed in this study are listed in the table below.

Table 5-5: Factors SME.

Factors	SME												Frequency		Percentage	
	1	2	3	4	5	6	7	8	9	10	11	12	Agree	Disagree	Agree	Disagree
Top Management Support	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11	1	93	7
Size of organisation	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y	Y	12	0	100	0
IT knowledge of employees	X	Y	Y	Y	Y	Y	Y	Y	Y	Y	X	Y	11	1	93	7
Technological Readiness	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12	0	100	0
Innovativeness of firm	X	Y	X	Y	X	X	Y	Y	X	X	X	X	4	8	33	67
Age of firm	Y	Y	X	X	X	X	X	Y	X	X	X	X	2	10	13	87

The results in Table 5.5 are discussed below:

5.3.2.1 *Top management Support*

About 93% of the participants agreed that top management support is vital to influence cloud computing in SMEs, while only 7% disagreed. The top management is the decision-makers who are privileged to formulate the vision and make an organisation's strategic decisions (Skafi et al., 2020). The findings appeared to show that top management is a significant factor in cloud computing adoption. The three SMEs below summarised the observations made by the majority during the interview.

SME5 observed:

> *"As top management, we need to know the benefits of cloud computing to our organisation so that we can decide whether to adopt or not."*

SME9 said:

> *"Top management is the decision-makers and therefore, should avail the necessary resources to adopt cloud computing."*

SME12 commenting on the power wielded by top management, said:

> *"If the top management does not give the green light to adopt, then the organisation cannot adopt and implement cloud computing."*

Top management support is a recurrent factor in the literature linked with SMEs' successful adoption of cloud computing. The findings of this part of the study corroborate previous studies (Amini & Bakri, 2015; Chathurika, 2019; Kumar et al., 2017; Martins et al., 2019; Sandu & Gide, 2019; Senarathna et al., 2016; Skafi et al., 2020) which confirm that the level of cloud computing adoption and implementation increases when there is top management support.

5.3.2.2 *Size of the organisation*

All the participants (100%) agreed that the size of an organisation is an essential factor in cloud adoption by SMEs. The number of employees determines the size of an organisation, the number of investments, the target market and annual revenue (Alkhater et al., 2018). The findings from this part of the study appear to show that an organisation's size was an essential factor in cloud computing adoption.

The findings of this part of the study are consistent with prior studies (Alkhalil et al., 2017; Bhuyan & Dash, 2018; Senarathna et al., 2018; Widyastuti & Irwansyah, 2018), which confirm that the size of an organisation is a vital factor in the adoption of new technology.

There are, however, mixed results on whether it is a small or large organisation that is predisposed to adopt cloud computing quickly. Some studies argue that large organisations have more resources, extensive skills base and experience at their disposal to adopt new technology quicker than small organisations (Senarathna et al., 2018; Widyastuti & Irwansyah, 2018). A study by OECD/ERIA (2018) confirms that small firms have a lower propensity to innovate than larger ones. On the other hand, other studies argue that, because of their size and less bureaucratic structure, small firms are more agile and flexible to adopt cloud computing than big organisations (Ayong & Naidoo, 2019; Bloom & Pierri, 2018).

5.3.2.2 *IT knowledge of Employees*

The findings show that about 93% of the participants agreed that IT knowledge of the employees positively affects cloud adoption. Prior technological experiences provide familiarity (Skafi et al., 2020), which boosts the confidence level of would-be users of the innovation. From this study, IT knowledge of employees appears to influence cloud computing adoption by SMEs. This what some SMEs had to say about this construct, SME7 said:

> *"Knowledge of the new technology is important because it gives a chance to know how it works and whether it is relevant to our organisation."*

SME3 observed that:

> *"Employees should be trained to appreciate how new technology works. Trained employees find it easy to perform their duties utilising cloud computing."*

SME11 remarked that:

> *"Knowing something about the technology makes you more confident and comfortable to use it, not knowing it brings in resentment and resistance."*

The study's findings are consistent with prior studies (Ayong & Naidoo, 2019; Chathurika, 2019; Prause, 2019; Sandu & Gide, 2019), which confirm the positive correction between cloud adoption and the IT knowledge of employees.

5.3.2.3 *Technological Readiness*

Based on the content analysis, 100% of the participants agreed that technological readiness was vital in cloud computing adoption. Technological readiness sets up the necessary IT infrastructure and human resources to influence cloud computing adoption (Senarathna et al., 2018). A firm with an adequate IT infrastructure, technically astute employees, and essential financial support can adopt cloud computing faster than any other firm (Moh'd Anwer, 2019). The findings appear to confirm that technological readiness is vital for cloud adoption in SMEs in Zimbabwe. Some comments from SMEs on the importance of technological readiness are presented below.

SME8 commented that:

> *"I can adopt cloud computing or any innovation if I have the right infrastructure and skilled human resource base."*

SME12 observed that:

> *"It is easy to adopt cloud computing if my firm is connected to the Internet with good speed and at the same able to afford the cost of data."*

Unsurprisingly these findings are consistent with results from prior studies that confirm the positive relationship between cloud computing adoption and technological readiness of an organisation (Gutierrez et al., 2015; Kandil et al., 2018; Moh'd Anwer, 2019; Nasser & Jawad, 2019; Senyo et al., 2016; Yoo & Kim, 2018).

5.3.2.4 *The innovativeness of the firm*

The findings reveal that about 67% of the participants disagreed with the statement that the innovativeness of the firm positively affects cloud computing adoption. In the context of this study, innovativeness means being open to try innovations (Prause, 2019). Previous studies show that SMEs' receptiveness towards new IT products plays a vital role in cloud computing adoption (Alshamaila et al., 2013). This study's findings show that the firm's innovativeness was not a significant factor in cloud computing adoption decisions.

invested a lot into their legacy systems and are risk-averse, and hence are less likely to innovate than young firms. This means that as the age rises, enterprises become more impervious to innovations. Therefore, young firms have a higher propensity to innovate because they are more agile and flexible than larger firms (BEIS Research Report, 2019; Uwizeyemungu, Poba-Nzaou, & St-Pierre, 2015).

The above assertion was refuted by Chang and Barun Dasgupta (2015), who found out that older firms were likely to adopt cloud computing faster because they have substantial financial resources and might recruit the right skill set when compared to smaller firms. This assertion is supported by Lu, Pishdad-Bozorgi, Wang, Xue, and Tan (2019), who reason that as SMEs grow old, their ability to identify and utilise applicable innovation increases compared to new SMEs.

5.3.3 **The Environmental Factors**

The environmental factors used in this study are shown in Table 5.6 below.

Table 5-4: The Environmental factors.

Factors	**SME**												**Frequency**		**Percentage**	
	1	2	3	4	5	6	7	8	9	10	11	12	Agree	Disagree	Agree	Disagree
Government Regulation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12	0	100	0
Competitive Pressure	Y	Y	Y	X	Y	Y	Y	Y	Y	Y	Y	Y	11	1	93	7
Information Intensity	X	Y	Y	Y	Y	Y	Y	Y	Y	X	Y	Y	10	2	83	17
External support	Y	Y	Y	Y	Y	Y	Y	Y	Y	X	Y	Y	11	1	93	7
Industry	X	Y	Y	Y	Y	Y	X	Y	Y	X	Y	Y	3	9	25	75
Market scope	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	8	4	67	33

The section below discusses the findings of the environmental factors.

5.3.3.1 *Government Regulations*

All the participants, 100% agreed that the government regulations affect cloud computing adoption by SMEs. Government regulations are measures provided by the government to encourage SMEs to adopt an innovation (Prause, 2019). The measures may include incentives, good infrastructure, and reasonable policies. The government is expected to encourage the building of infrastructure and services that support quality internet connections to SMEs (Widyastuti & Irwansyah, 2018). The government should also spearhead the designing and formulation of a regulatory policy framework that protects SMEs and service providers. Of importance, the government must assist in creating awareness and support programs to encourage SMEs to adopt cloud computing (Raut, Gardas, Jha, & Priyadarshinee, 2017; Senarathna et al., 2016). The findings of this study appear to confirm that government regulations have an impact on cloud computing adoption. Below are some of the views expressed by different SMEs about the role of government in cloud adoption.

SME4 observed:

> *"I have never heard of government policy on cloud computing, so at the moment, I do not think the government is able to support us adopt the innovation."*

The same sentiment was shared by SME7:

> *"The lack of regulations and policies can be attributed to the fact that cloud computing is still new in our country."*

SME9 suggested that:

> *"Surely, the government should put in place some regulations to have some control and protect us when we adopt cloud computing."*

The findings of this study are consistent with previous studies in Denmark, Australia, Africa and Saudi Arabia (Ali, Shrestha, Osmanaj, & Muhammed, 2020; Awiagah, Kang, & Lim, 2016; Dwivedi, Alalwan, Rana, & Williams, 2015; Paul Taylor, 2019) that reveal that there is a significant positive relationship between cloud computing adoption and government regulations.

5.3.3.2 *Competitive Pressure*

Based on the content analysis, about 93% of the participant agreed that competitive pressure was vital to force SMEs to adopt cloud computing. Competitive pressure is a competition that other firms subject to one firm within the same type of industry (Senarathna et al., 2018). When SMEs are subjected to intense competition, they tend to respond by aggressively implementing innovations (Chathurika, 2019; Gangwar et al., 2015). The innovations should establish new business models to counter competition from other SMEs (Prause, 2019). This study's findings show that competitive pressure is an essential determinant of cloud computing adoption by SMEs.

Even though the SMEs in this study are from diverse sectors, this study's findings corroborate findings from previous studies (Chathurika, 2019; Gangwar et al., 2015; Prause, 2019) confirmed that competitive pressure has a significant and positive relationship with cloud adoption.

5.3.3.3 *The Information Intensity*

The study's findings show that about 83% of the participants agreed that information intensity is an essential factor in cloud computing adoption, while about 17% disagreed. This split in opinion could mean that the SMEs have different information needs. Information intensity means that SMEs should have access to information whenever required (Chiu et al., 2017). The information should be reliable, relevant, accurate, and up to date all the time (Alshammari, 2019; Skafi et al., 2020). The findings show that information intensity seems to be an essential factor in the adoption of cloud computing. SME5 aptly summarises this:

> *"Information intensity, yes, we need quick and up to date information all the time, and I think the same goes for all other SMEs, especially those in the finance sector."*

There are conflicting results from previous studies about the significance of information intensity in adopting an innovation. The findings of this study are consistent with prior studies (Chiu et al., 2017; Gangwar et al., 2015; Paul Taylor, 2019; Tehrani & Shirazi, 2014; Ullah, Buckley, Garvey, & Li, 2019)) that confirm a positive correlation between cloud computing and cloud adoption by SMEs. However, these results contradict findings by Ali et al. (2018) and M. Ali, Khan, and Vasilakos (2015) that show information intensity as insignificant to cloud computing adoption.

5.3.3.4 *External Support*

The majority, 93% of the respondents, agreed that external support is essential for cloud computing adoption by SMEs. External support in the context of this research is the support offered to SMEs by cloud services providers. Cloud service providers should provide technical and operational cloud computing services to their clients at competitive rates (SMEs) (Kumar et al., 2017; Skafi et al., 2020). Organisations may be more willing to try new technology if they feel there is sufficient support (Isma'ili & Zahir, 2017).

The findings appear to support that external support is vital in cloud computing adoption. Some of the comments from the participants are recorded below;

SME7 reasoned that:

> *"The more information you have about anything, the more informed choice you can make."*

Supporting the above point, SME8, commented that:

> *"Service providers should market their products so that we can make a selection based on our needs."*

SME12 had this to say:

> *"Service providers must train us on how to make maximum use and reap maximum benefits from the cloud."*

The findings of this study seem to be consistent with previous studies (Alkhater et al., 2018; Kumar et al., 2017; Skafi et al., 2020; Ullah et al., 2019; Widyastuti & Irwansyah, 2018), which found that external support is very vital in the adoption of cloud computing by SMEs. Some studies argue that the impact of external support depends on the size of an organisation; thus, the impact of external support is smaller in SMEs than in larger organisations (Alkhater et al., 2018; Bhuyan & Dash, 2018; Senarathna et al., 2018).

5.3.3.5 *Market Scope*

Based on content analysis, 67% of the interviewees agreed that market scope was significant in cloud computing. The market scope is defined as the geographical extent of the SME's operations (Hsu & Lin, 2016). By adopting cloud computing, it is assumed that any organisation can expand its geographical scope and reach any market anywhere at any time. If a company operates in a vast market area, it tends to adopt cloud computing to improve efficiency (Skafi et al., 2020). The results of this part of this research appear to confirm that market scope is an essential factor in cloud adoption by SMEs.

The findings of the research are not unique as they confirm with finding from prior studies (Al-Hujran et al., 2018; Harfoushi et al., 2016; Skafi et al., 2020)(Al Ismaili et al., 2016; Ray, 2016) that market scope is a significant factor in cloud computing adoption. However, these results contradict some previous findings (Senyo et al., 2016) that suggest an indirect link between market scope and cloud adoption.

5.3.3.6 *Industry*

The findings show that about 75% of the participants disagreed that industry type significantly impacted cloud computing adoption. Industry type describes the sector in which an SME operates ((Raut et al., 2017; Senarathna et al., 2016). The findings of this part of research appear to show that industry type has an insignificant impact on cloud adoption by SMEs in Zimbabwe.

Previous studies show mixed results on the impact of industry type on cloud adoption (Isma'ili & Zahir, 2017; Lu et al., 2019; Sayginer & Ercan, 2020). Some studies suggest there is a positive correlation between the type of industry and cloud adoption (Alsanea, 2015; Sayginer & Ercan, 2020), while other studies show no correlation (Alkhater et al., 2018; Isma'ili & Zahir, 2017). Other studies reported that different organisations are at different levels of ICT adoption (Lu et al., 2019) and point out that the SMEs in the technology and financial sector have a higher propensity to adopt cloud computing (Isma'ili & Zahir, 2017; Low, Chen, & Wu, 2011; Lu et al., 2019) than any other industry. However, the study's findings are consistent with some prior studies (Alkhater et al., 2018; Isma'ili & Zahir, 2017; Lu et al., 2019) that found no positive correlation between industry type and cloud adoption.

5.4 SUMMARY OF THE FINDINGS

This was an exploratory part of the research. The purpose of this part of the research was to highlight the influential factors that affect the adoption of cloud computing by SMEs in Zimbabwe. The table below shows the summary of the interview results showing factors affecting the adoption of cloud computing by SMEs in Zimbabwe.

Table 5-7: Summary of the interview results.

Category	Theme	Supported/ Not Supported	Evident in investigated SMEs
Technological Factors	Reliability	Not supported	2,4-10;12
	Relative Advantage	Supported	2-4; 5-12
	Compatibility	Supported	1-12
	Security	Supported	1-12
	Complexity	Supported	2-12
	Cost Savings	Supported	1-3, 5-12
	Trialability	Supported	3-12
	Uncertainty	Not supported	1,2,5-7, 9-11
	Trust	Not supported	2-5, 8-12
	Observability	Not supported	1-5,9-11
Organisational Factors	Top Management Support	Supported	2-12
	Size of organisation	Supported	1-12
	IT knowledge of employees	Supported	2-12
	Technological Readiness	Supported	1-12
	Innovativeness of firm	Not supported	3,5,6, 8-12
	Age of firm	Not supported	3-7, 9-12
Environmental Factors	Government Regulation	Supported	1-12
	Competitive Pressure	Supported	1-3, 5-12
	Information Intensity	Supported	2-6, 7-9, 11,12
	External support	Supported	1-9, 11,12
	Industry	Not supported	2-6,8,9,11,12
	Market scope	supported	1,4-10,11,12

Both the supported and unsupported themes have taken from DOI and TOE from previous studies. Thus, the supported themes are perceived as adequate and competent for further investigation. This means that the results of this exploratory phase of the study qualify to be further investigated in the next quantitative phase of this research. This exploratory phase will be used to design a questionnaire that will be used in the quantitative phase to refute or confirm if these factors affect cloud computing adoption by SMEs in Zimbabwe. The results from the table were used to design a new intermediate model, as shown below.

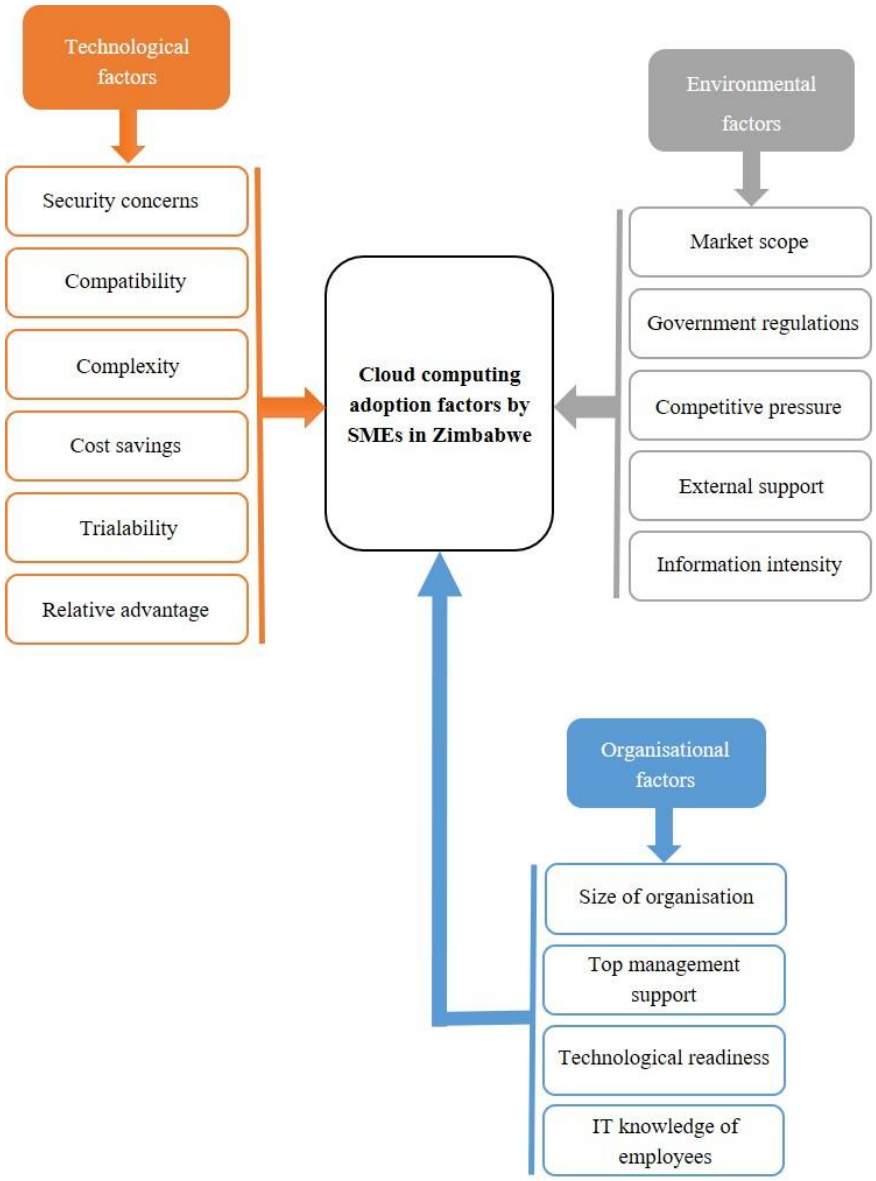

Figure 5-1: The Intermediate Model.

The intermediate model is a result of the qualitative study. This chapter's results were used to validate the initial cloud computing adoption framework presented in Chapter 4 of this study. Some of the preliminary model factors were not supported (as shown in Table 5.7) during the qualitative phase of this study. The intermediate model will be quantitatively validated and refined during the next quantitative stage of this study.

5.5 CONCLUSION

This chapter has covered the analysis of the qualitative data gathered from the interviews. The analysis was Phase 2 of this study, and the findings provided a foundation for the next stage of the research. The factors affecting cloud computing adoption are classified into technological factors, organisational factors and environmental factors. The factors analysed in this chapter came from the preliminary model in Chapter 4. There are fifteen main factors identified as playing a significant role in SME cloud adoption in this study: Relative advantage, compatibility, security, complexity, cost savings, trialability, top management support, size of the organisation, IT knowledge of employees, Technological readiness, Government regulations, Competitive pressure, Information intensity, External support and Market scope.

Thus, factors not supported during the data analysis do not warrant further confirmation in the next quantitative stage and will be dropping. The rejected factors were reliability, uncertainty, trust, and observability, which fall under technological factors. Two factors, innovativeness and age of firm under organisational factors, were not supported. Only one factor, type of industry, was not supported under environmental factors. The following chapter will report quantitative data analysis found in phase 3 of this research.

CHAPTER 6 QUANTITATIVE DATA ANALYSIS AND MODEL EVALUATION

6.1 INTRODUCTION

The previous chapter provided an exploratory study that formed Phase 2 of this study. The exploratory study used 12 telephonic interviews with decision-makers in the SMEs. It provided analysis and discussions on the influential factors in an organisation's decision to adopt cloud computing technology by SMEs in Zimbabwe. This chapter is Phase 3 of this study, a quantitative study to confirm if the results in Chapter 5 are the most influential factors promoting cloud adoption by SMEs in Zimbabwe. SPSS package version 26 was used to calculate descriptive and inferential statistics measures. As outlined in Chapter 2, this research used design science methodology. Besides confirming the influential factors affecting cloud adoption by SMEs in Zimbabwe, this chapter also validates and re-evaluates the intermediate cloud adoption framework artefacts in Chapter 5. The findings of this chapter will help produce a final cloud computing adoption framework.

6.2 RESPONSE RATE AND DATA CLEANING

Participants were invited to participate in an online survey questionnaire. The questionnaire was created using the SurveyMonkey.com website. The questionnaire link was distributed through social media (WhatsApp) and emails to the sampled SMEs, as explained in Section 2.14. The survey was conducted from May 2020 to July 2020. A total of 345 participants were invited to participate in the survey. Two hundred fifty responses were received, making an initial response rate of about 72%. However, 38 questionnaires were invalid because they had some missing data. Hair et al. (2013) recommend that the missing values be replaced using mean if they were less than 5% per item. For this study, the missing values were more than 5%; thus, the questionnaires were discarded because they were unfit for further analysis.

After data cleaning, the number of valid responses was 212, making a valid response rate of 61%. This response rate is regarded as high because it is above the minimum recommended responses rate of 20% for organisational online surveys (Adam et al. 2019).

Besides, a 61% response rate is above other rates obtained in some IS studies (Adam et al.,2019; Williams et al.,2009). According to Orodho (2009), a response rate of above 50% is enough to provide useful data. A high response rate reduces response bias error and gives more confidence to the results, thus leveraging the results' generalisability and validity (Agustini, 2018). The high response rate was that the collection period spanned over three months and that several follow-ups and reminders were sent through emails and as WhatsApp messages to the respondents. Lower response rates of online surveys have been a big concern for researchers (Krosnick et al.,2015; Yan and Fan 2010) and to overcome this challenge, and like what was done in this research, using a multimode approach increases the response rate as opposed to the use of a single-mode (Loomis and Patterson, 2018).

6.3 DEMOGRAPHIC CHARACTERISTICS

The targeted respondents were individuals who could make decisions in their organisations (Owners, Managers, Chief Executive officers). The study looked at these demographic characteristics, gender, age, position in the organisation, educational qualifications, type of business, number of employees, number of years in operation, and cloud-based applications currently in use. While demographic data (see Sections 2.14.2 and 2.14.3) may not have a bearing on data analysis, it is important to contextualise and understand the SMEs' general characteristics under study. As Lu et al. (2006) advised, less emphasis should be placed on the direct effects of the demographic characteristics in data analysis. However, some previous studies show that demographic characteristics influence ICT adoption and its usage intensity (Dwivedi et al., 2015; Muinde, 2009). Studying personal characteristics like age, education, gender, and so on is of paramount importance because it is argued that they can provide powerful insight to cloud service providers to customise their services for particular target groups (Muinde, 2009). Interestingly, examining organisational characteristics like location, size, experience, number of employees, and many others indicate the important organisational characteristics for determining the adoption and use of ICT (Lee and Kim, 2007).

This information may be useful to the government to provide the necessary policies and infrastructure to cater for diverse SMEs. Simultaneously, the information may help cloud service providers know their clientele base and customise their services to meet the needs of all the different sectors of SMEs. The following section shows the position of respondents in their respective SMEs.

6.3.1 **Position in the SME**

Table 6-1: Position of respondents

Frequency		Valid Percent
Owner	169	79.7
Manager	33	15.6
Other	10	4.7
Total	212	100.0

In terms of the positions held in the SMEs, Table 6.1 reveals that the majority of the respondents, 169 (79.7%) were owners of the SMEs, followed by managers at 33 (15.6%) and lastly, others (employees with express authority to complete the questionnaire) at 10 (4.7%).

The following table shows the educational qualifications of the respondents, and this is further displayed in Figure 6.1.

Table 6-2: Educational qualifications

		Frequency	**Valid Percent**
Valid	Primary School	1	0.5
	Secondary School	4	1.9
	Diploma	39	18.4
	First Degree/Bachelors	129	60.8
	Master’s degree	36	17.0
	Doctoral Degree	3	1.4
	Total	212	100.0

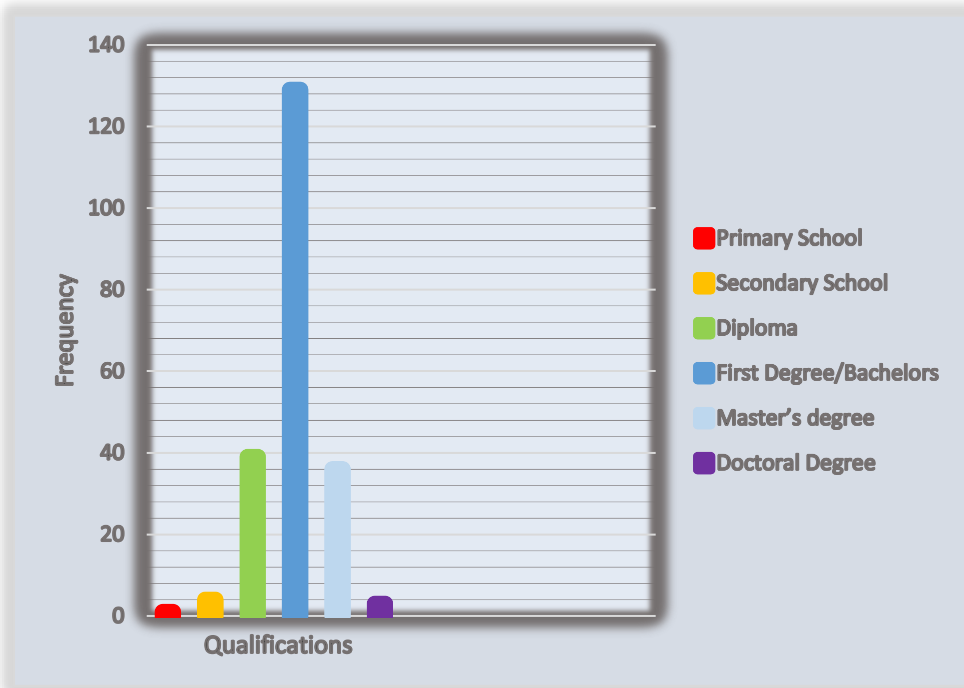

Figure 6-1: Educational qualifications.

The information in Table 6.2 was converted to a graph as shown in Figure 6.1 reports that most of the respondents 129 (60%) acquired a first degree (bachelors) followed by 39 (18.4%) has a diploma. 36 (17.0%) of the participants acquired a master's degree, while 3 (1.4%) have a doctoral degree. At the lower end of the qualifications, 4 (1.9%) respondents have a secondary school certificate, while only 1 (0.5%) acquired a primary school certificate as their highest qualification. The statistics may not have direct relevance to this study but could help cloud service providers know their clientele base and customise their services to meet the needs of all the different SME sectors.

The following section shows the different types of businesses engaged by SMEs.

6.3.2 Type of Business

Table 6-3: Type of business engaged by SMEs

		Frequency	Per cent
Valid	Communication	4	1.9
	Construction	17	8.0
	Farming	35	16.5
	Pharmaceuticals	16	7.5
	Textile and Clothing	30	14.2
	Grocery/Food Processing	22	10.3
	Chemical/Electrical Products	21	9.9
	Manufacturing	9	4.2
	Carpentry and Wood Curving	18	8.5
	Finance	6	2.8
	Transport	14	6.6
	IT	17	8.0
	Other	3	1.41
	Total	212	100.0

Table 6.3 reports the different types of business conducted by the participating SMEs. Farming at 35 (16.5%) is the most subscribed type of business. This is not surprising because agriculture/farming is one of the most significant sectors of the economy, accounting for about 21% of the GDP and is the primary source of livelihood, employment, and income for around 67 per cent of the population in Zimbabwe (World Bank Group, 2019). Textiles and Clothing follow this at 30 (14.2%), a by-product of agriculture. 22 (10.3%) are engaged in groceries and 21 (9.9%) in chemicals/electrical products. As suggested by the respondents, the least subscribed type of business is listed as the 'other' industries. These include some businesses not included in the table above (craft shop, a charity organisation, mining and engineering). The results in the table are shown graphically below in Figure 6.2

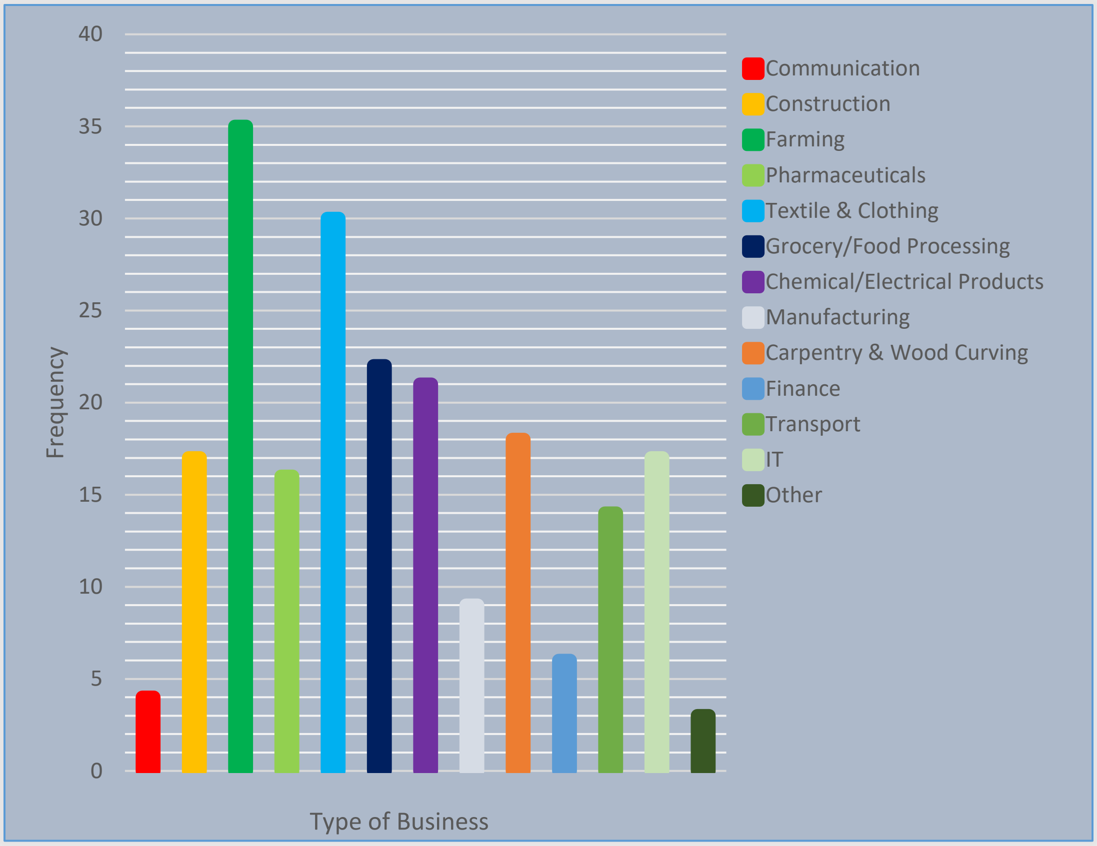

Figure 6-2: Type of business.

The following section displays the results of the number of employees in the sampled SMEs.

6.3.3 **Number of Employees**

The following table depicts the number of employees at the SMEs.

Table 6-4: Number of employees

	Statistic
Mean	4.47
Minimum	1
Maximum	12
Range	11

The size of an organisation is defined by the number of employees (AlKhater et al.,2014). Past research suggests that larger SMEs with their number of employees have a more extensive resource base and capabilities to explore new technologies (Lu et al.,2019). This means that as the organisation expands and grows more prominent, there is a higher propensity to adopt new technology. Some argue that the smaller organisations by their small nature are more flexible and thus are better predisposed to cloud adoption than more prominent organisations (Lu et al., 2019; Widyastuti and Irwansyah, 2018).

In Table 6.4, the size of the SME was identified by the number of employees. The table reveals that the mean number of employees was 4.47 translating to an average of 5 employees in every SME. The largest SME has 12 employees, and the smallest has one employee, giving a range of 11. The information about the number of employees was presented in a histogram as depicted in Figure 6.3 below.

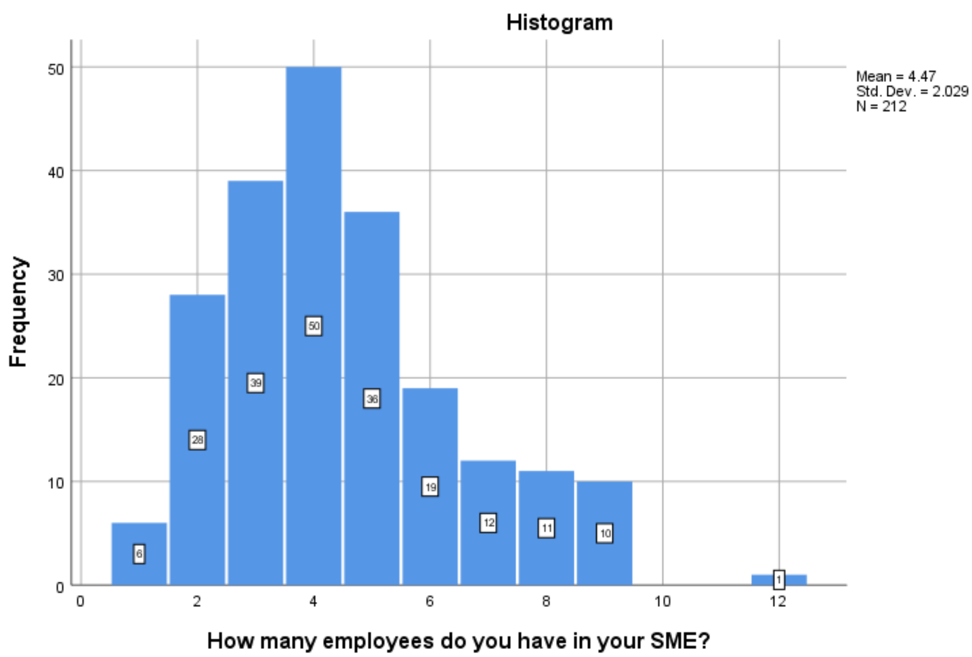

Figure 6-3: Number of employees.

The graph shows the frequency of the number of employees of the participating SMEs. The most significant number of SMEs have an average of 4 employees instead of what is shown in the table. The number inscribed on each bar shows the number of employees in terms of percentages. Generally, many SMEs have between 2 and 5 employees. The following section shows the number of years SMEs have been operational.

6.3.4 Number of years in operation

Table 6-5: Number of years in operation

Number of years in operation (Age of SME)			
	Years in operation	Frequency	Per cent
	1-5 years	167	78.8%
	6-10 years	44	20.7%
	11-15 years	1	0.5%
	Total	212	100%

Table 6.5 shows the number of years in operation of the SMEs, which is the organisation's age. The age ranges from between 1 and 5 years to between 11 and 15 years. Most of the SMEs (78.8%) are clustered in the 1 to 5 age range signifying that they are still very young. 44 (20.7%) range between 6 and 10 years and only 1 (0.5%) above ten years. The section below shows by count and percentage the market scope of the SMEs.

6.3.5 Market Scope

Table 6-6: Market scope

		No	Yes	Total
Local Market	Count	16	196	212
	Row N %	7.5%	92.5%	100.0%
National Market	Count	117	95	212
	Row N %	55.2%	44.8%	100.0%
Regional Market	Count	191	21	212
	Row N %	90.1%	9.9%	100.0%
International Market	Count	204	8	212
	Row N %	96.2%	3.8%	100.0%

The information in the above table shows the market scope of the respondents. The market scope is the geographical extent of the SME's operations (Hsu and Lin, 2016). Most, 196 (92.5%) of the respondents have a local market scope, 95 (44.8%) of the respondents have a national market scope. 21 SMEs, which is about 9.9% of the respondents cater to the regional market while only 8 (3.8%) cater to the international market. The results show that most of the SMEs cater predominantly for the local market. Thus, by adopting cloud computing SMEs are likely to penetrate new markets.

Additionally, according to Skafi et al. (2019), a company that operates on a broader market area tends to adopt cloud computing faster to improve efficiency than those predominantly operating within a local market. The next section displays the cloud-based applications currently being used in the participating SMEs.

6.3.6 **Cloud-based applications being used by your organisation.**

Table 6-7: Cloud-based applications being used by your organisation

Cloud-based application		**No**	**Yes**	**Total**
Email	Count	10	202	212
	Row N %	4.7%	95.3%	100.0%
Email Marketing	Count	133	79	212
	Row N %	62.7%	37.3%	100.0%
Web conferencing	Count	180	32	212
	Row N %	84.9%	15.1%	100.0%
Collaborative Software	Count	184	28	212
	Row N %	86.8%	13.2%	100.0%
File storage and sharing	Count	159	53	212
	Row N %	75.0%	25.0%	100.0%
E-Commerce	Count	180	32	212
	Row N %	84.9%	15.1%	100.0%
Other	Count	202	10	212
	Row N %	95.3%	4.7%	100.0%

Evidently, from Table 6.7, most respondents, 202 (95%) use basic internet services (email) to conduct their day-to-day business. About 79 (37.3%) use email marketing, and 32 (15.1%) use web conferencing as a cloud-based application and the same number of respondents, 32 (15.1%) use e-commerce as a cloud-based application. 53 (25%) use cloud computing for file storage, and only 28 (13.2%) benefit from cloud computing by using collaborative software while 10 (4.7%) 'other' as suggested by the respondents use cloud-based applications such as social media platforms (WhatsApp, Facebook and Twitter) for their business transactions. The results seem to show that most SMEs tend to use basic Internet services that seem to be more valuable to them on an operational rather than strategic level (Alshamaila et al. 2017). The results are not surprising as observed by Parida et al. (2010) that SMEs do not adopt sophisticated technology because it is unfeasible and, in most cases, may not suit the simple nature of their business operations. More so, advanced technology is perceived to be too complicated and expensive for SMEs (Cathurika, 2019; Alshamaila et al. 2017).

6.4 CUSTOM TABLES

Customer tables were used in this study to measure the perception of SMEs on technological, organisational and environmental cloud adoption. To improve readability and comprehension, the two lower and two upper ends of the five-point Likert scale from the questionnaire were combined, that is, 'strongly disagree' and 'disagree' results were combined to form the total negative results which were compared with the aggregated 'agree' and 'strongly agree' positive results. The 'neutral' scale was not changed. The following section discusses each variable's frequency, percentage, mean and standard deviation in the three constructs (technological, organisational and environmental), as shown below (Tables 6.8 to 6.21). The sections are arranged as technological factors, organisational factors, and environmental factors.

6.4.1 **Descriptive statistics of Technological Factors**

Table 6-8: Relative Advantage (RA).

Relative Advantage (RA)			Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
RA1	Adopting cloud computing would allow us to use the latest version of the technology.	Count	2	7	203	4.28	0.618
		Row N %	0.90%	3.30%	95.8%		
RA2	Using cloud computing would allow better communication with our suppliers and customer.	Count	0	8	208	4.33	0.544
		Row N %	0.00%	3.80%	96.2%		
RA3	Using cloud computing would allow us to penetrate new markets.	Count	0	10	202	4.34	0.567
		Row N %	0.00%	4.70%	95.30%		
RA4	Using cloud computing would make it easier for us to do our job.	Count	4	9	199	4.31	0.706
		Row N %	1.90%	4.20%	93.90%		
RA5	Cloud computing would enhance our company's data storage capacity	Count	1	6	205	4.41	0.597
		Row N %	0.50%	2.80%	96.70%		
TOTAL						4.33	0.606

Harfoushi et al., (2016) define relative advantage as the degree to which an innovation is perceived as better than the idea it superseded. Thus, cloud computing which offers both technical and economic advantages to SMEs should be better than traditional IT systems currently used. This study sought to establish the relative advantage of cloud computing among the sampled SMEs in Harare and Bulawayo (Zimbabwe).

As indicated in the table above, 203 (95.8%) respondents agreed/strongly agreed that adopting cloud computing would allow them to use the latest version of the technology. (M = 4.28, Std Deviation = 0.618). This meant that it would be cheap for SMEs to adopt cloud computing because there would be no need for SMEs to buy the latest versions of the technology for their legacy systems. Also, 208 (96.2%) of the respondents agreed/strongly agreed that ‘Using cloud computing would allow better communication with our suppliers and customer’ (M=4.33, Std Deviation=0.544). About 202 (95.30%) respondents agreed/strongly agreed that by adopting cloud computing, they would expand their businesses by penetrating new markets (M=4.34, Std Deviation = 0.567). Furthermore, about 199 (93.90%) of the participants agreed/strongly agreed that adopting cloud computing would make their SMEs more efficient (M=4.31, Std Deviation=0.706) and would eventually contribute to profitability. Lastly, about 205 (96.7%) respondents agreed/strongly agreed that cloud computing would offer advantages of enhancing their SME’s data storage capacity (M=4.41, Std Deviation=0.597).

Moreover, the summated mean of 4.33 and a standard deviation of 0.606 confirm that the respondents agreed/strongly agreed that adopting cloud would offer many advantages to their SMEs.

Table 6-9: Descriptive Statistics Compatibility.

	Compatibility (CP)		Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
CP1	Cloud computing is NOT compatible with other systems that we are using.	Count	114	22	76	2.80	1.201
		Row N %	53.70%	10.40%	35.90%		
CP2	Cloud computing can easily be integrated into our existing IT infrastructure.	Count	22	27	163	3.72	0.738
		Row N %	10.40%	12.70%	76.90%		
CP3	Using cloud computing is compatible with our company's business model.	Count	49	54	108	3.30	0.919
		Row N %	23.60%	25.50%	50.90%		
CP4	Using cloud computing fits well into our company's work style.	Count	50	48	114	3.34	0.903
		Row N %	23.60%	22.60%	53.80%		
CP5	We would use cloud services if they were consistent with our needs.	Count	0	12	200	4.42	0.598
		Row N %	0.00%	5.70%	94.30%		
OVERALL						3.52	0.872

Harfoushi et al., (2016) describe compatibility as the extent to which an innovation fits with existing organisational values, culture and practices. To increase adoptability, the innovation must be consistent with their ways of doing business. This study would want to establish the state of compatibility of cloud computing adoption within the existing organisational systems of the sampled SMEs in Harare and Bulawayo.

The table above reveals that four out of five questionnaire items have mean values above 3, implying that most of the observed items have positive responses towards many of the items in this construct. Thus, 200 (94.3%) of the respondents agreed/strongly agreed that they would use cloud computing services if they were consistent with their needs (M=4.42, Std Deviation=0.598), 163 (76.9%) confirmed that cloud computing could be easily integrated into their existing IT infrastructure (M=3.52, Std Deviation=0.738). However, 114 (53.7%) seemed to disagree/strongly disagree with the negative statement that cloud computing was not compatible with other systems they were using. Overall, the summated mean score and standard deviation are 3.52 and 0.87, respectively conforming to the respondents' agreement to statements in this construct. However, future studies should highlight which SMEs have the compatible and incompatible infrastructure to adopt cloud computing.

Table 6-10: Security

	Security (S)		Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
S1	Cloud computing provides a sufficient security transfer channel during the process of mass data interchange.	Count	66	50	126	3.349	0.846
		Row N %	17.00%	23.60%	59.40%		
S2	Using cloud computing system solutions are trustworthy	Count	34	56	122	3.349	0.846
		Row N %	16.00%	26.40%	57.60%		
S3	Cloud provider data centres provide greater security of data.	Count	63	57	123	3.35	0.857
		Row N %	15.10%	26.90%	58.00%		
S4	Cloud provider data centres have effective backup systems	Count	21	43	148	3.73	0.809
		Row N %	9.90%	20.30%	69.80%		
S5	Security, in general, is a critical issue that affects our decision to use cloud services.	Count	9	13	190	4.23	0.784
		Row N %	4.20%	6.10%	89.60%		
S6	I feel that cloud computing is not secure enough to store our organisation's data.	Count	50	25	137	3.73	1.287
		Row N %	23.60%	11.80%	64.60%		
OVERALL						3.62	0.905

It is evident from the analysis in Table 6.10 that all the items have a mean value above three, implying the respondents seemed to agree/strongly agree on the items in the security construct. 190 (89.6%) agreed/strongly agreed that security, in general, was a critical issue that affected their decision to use cloud services. Additionally, the summated mean score of 3.62 and standard deviation of 0.905 further confirm the respondents' positive affirmations, indicating a degree of agreement in SMEs' perception of the impact of security in cloud computing adoption.

Table 6-11: Complexity

	Complexity (CX)		Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
CX1	Working with cloud computing is complicated; it is difficult to understand what is going on.	Count	55	22	135	3.49	1.116
		Row N %	25.90%	10.40%	63.70%		
CX2	It takes too long to learn how to use cloud computing to make it worth the effort.	Count	53	20	139	3.52	1.099
		Row N %	25%	9.40%	65.60%		
CX3	Learning to operate the cloud computing system is easy for me.	Count	97	46	69	2.81	1.018
		Row N %	45.70%	21.70%	32.60%		
CX4	It takes too much time for me if I want to use cloud computing to do my normal duties.	Count	64	34	114	3.28	1.051
		Row N %	30.20%	16.00%	53.80%		
CX5	In general cloud computing is very complex.	Count	40	28	144	3.80	1.155
		Row N %	18.80%	13.20%	68.00%		
OVERALL						3.38	1.098

According to Cathurika (2019), complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. Innovation needs to be user-friendly and easy to use to increase its adoption rate. The study sought to establish the respondents' perceptions or experiences of the complexity of adopting cloud computing in the selected SMEs in Harare and Bulawayo.

Table 6.11 presents the frequency distribution of items measuring the complexity construct. The means range from the lowest M=2.81(Std Deviation=1.018) to the highest M=3.80 (Std Deviation =1.155). The lowest mean is for item CX3- 'learning to operate the cloud computing system is easy for me' and the highest mean for item CX5- 'in general cloud computing is very complex.' Inconspicuously the results show variations in how the respondents answered the item statements across the upper and lower Likert scales. The responses are distributed across all the Likert scales with some agreeing that using cloud computing is difficult while others disagree. 144 (68.0%) agreed/strongly agreed and perceived that cloud computing was very complex; 139 (65.6) agreed/strongly agreed that 'It takes too long to learn how to use cloud computing to make it worth the effort'; 135 (63.7%) agreed/strongly agreed that 'Working with cloud computing is complicated, it is difficult to understand what is going on' and the tail end of the upper scale, 114 (53.8%) respondents agreed/strongly agreed that 'It takes too much time for me if I want to use cloud computing to do my normal duty. Quiet many respondents, 97 (45.7%) disagreed with the item CX3 'Learning to operate the cloud computing system is easy for me.' However, overall, the summated mean score of 3.38 shows that many respondents agree/strongly agree that using cloud computing is complex.

Table 6-12: Cost Savings

	Cost (C)		Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
C1	Cloud computing decreases the investment in new IT infrastructure in our organisation.	Count	31	21	165	3.92	0.994
		Row N %	12.30%	9.90%	77.80%		
C2	Cloud computing eliminates the cost of upgrading the IT system in our organisation.	Count	11	22	179	4.08	0.827
		Row N %	5.20%	10.40%	84.50%		
C3	Deploying cloud computing involves high costs.	Count	19	32	161	3.97	0.946
		Row N %	8.90%	15.10%	75.90%		
C4	Costs of using the Internet are very high in Zimbabwe.	Count	1	4	207	4.42	0.582
		Row N %	0.50%	1.90%	97.60%		
C5	Cost of high bandwidth and availability of the Internet will be an issue for my organisation's decision to adopt cloud computing.	Count	4	11	197	4.39	0.697
		Row N %	1.90%	5.20%	92.90%		
OVERALL						4.16	0.809

The table results show that all the observed items in the construct have positive responses towards the cost construct for cloud computing adoption. 207 (97.6%), the highest percentage, respondents agreed/strongly agreed with item C4 that the 'Costs of using the internet are very high in Zimbabwe', for item C5, 197 (92.9%) respondents agreed/strongly agreed that, 'Cost of high bandwidth and availability of the internet will be an issue for my organisation's decision to adopt cloud computing', and lastly 179 (84.5%) agreed that adoption of cloud computing would eliminate the cost of upgrading their IT systems. The mean values of all items in this construct are above 3, with C2, C4 and C5 well above the mean score of 4. A summated mean value of 4.16 indicates that most of the respondents agreed/strongly agreed that cost is an essential factor in cloud computing adoption.

Table 6-13: Trialability

Trialability (T)			Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
T1	I have a great deal of opportunity to try various types of cloud computing. .	Count	145	8	59	2.36	1.133
		Row N %	68.4%	3.8%	27.8%		
T2	I am permitted to use cloud computing on a trial basis for long enough to see what it could do	Count	142	17	53	2.36	1.095
		Row N %	67.0%	8.0%	25%		
T3	Cloud computing is available to me to adequately test run various applications.	Count	135	19	58	2.51	1.104
		Row N %	63.7%	9.0%	27%		
T4	Being able to use cloud technology on a trial basis will encourage us to adopt it in our organisation.	Count	3	3	206	4.17	.556
		Row N %	1.4%	1.4%	97%		
T5	It is necessary to know how to deal with the services of cloud computing before deciding to adopt it. .	Count	1	3	208	4.32	.552
		Row N %	0.5%	1.4%	98%		
OVERALL						3.14	.888

According to Johnson et al. (2020), trialability is the extent to which an individual is given an opportunity to experiment with innovation before making an adoption decision. This opportunity is availed to an individual or organisation to use the technology on their premises and evaluate it to see if it meets their needs. Thus, this part of the study sought to understand the respondents' perceptions of the extent to which trialability can affect their decision to adopt cloud computing.

Table 6.13 that the first three items, T1- 'I have a great deal of opportunity to try various types of cloud computing'; T2- 'I am permitted to use cloud computing on a trial basis for long enough to see what it could do' and T3 – ' Cloud computing is available to me to adequately test run various applications' have their mean value clustered on the left-hand side of the overall mean value. This shows that most of the respondents disagreed/strongly disagreed with the three items in this construct. This is also evidenced by the three items' mean score values, which are less than 3. Regarding items, T4 and T5, 206 (97%) agreed/strongly agreed that T4- 'Being able to use cloud technology on a trial basis would encourage us to adopt it in our organisation', and 208 (98%) agreed/strongly agreed that 'It is necessary to know how to deal with the services of cloud computing before deciding to adopt it. The mean scores of T4 and T5 support that many of the respondents agreed/strongly agreed that the trial of cloud technology on their premises and knowing where to go for cloud computing services would affect the technology's adoptability. The summated mean is above the mean score of 3, which seems to confirm that many respondents agree/strongly agree on the importance of trialability construct in cloud adoption.

6.5 DESCRIPTIVE STATISTICS OF ORGANISATIONAL FACTORS

Table 6-14: Top Management Support construct

	Top Management Support (TMS)		**Strongly Disagree/ Disagree**	**Neutral**	**Strongly Agree/ Agree**	**Mean**	**Std. Deviation**
TMS1	Top management is willing to take the risks (financial and organisational) involved in adopting cloud computing.	Count	16	21	175	3.83	0.750
		Row N %	7.50%	9.90%	82.50%		
TMS2	Top management understands the benefits of cloud computing in our organisation.	Count	26	31	155	3.74	0.885
		Row N %	12.30%	14.60%	73.10%		
TMS3	Top management is seriously considering the adoption of an appropriate cloud system in my organisation.	Count	10	38	164	3.89	0.780
		Row N %	4.70%	17.90%	77.40%		
TMS4	Top management provides resources to support the adoption of cloud computing.	Count	13	27	172	4.02	0.854
		Row N %	6.10%	12.70%	81.10%		
TMS5	The decision to adopt cloud services in our organisation depends on top management.	Count	4	9	199	4.29	0.680
		Row N %	1.90%	4.20%	93.90%		
OVERALL						3.95	0.790

Top management's support is essential to the successful adoption of new technology. Skafi et al. (2020) report that top management support is positively associated with SMEs' likelihood of cloud adoption. Top management should initiate, set up an organisational strategy for adopting new technology, secure enough resources and implement the new technology with their organisation (Harfoushi et al. 2016). Therefore, this part of the study sought to establish the level of top management support concerning cloud computing adoption.

From the results in the above table, the top management, 175 (82.50%) exhibited a willingness to take the risks (financial and organisational) involved in adopting cloud computing (M=3.83, Std Deviation =0.750). This implied that there was adequate support from the top management, which is essential for cloud adoption in SMEs. 155 (73.10%) respondents understood the benefits of adopting cloud computing in their organisations which is an essential indication that the top management could support cloud computing adoption (M=3.74, Std Deviation=3.74, 0.885). On the same note, about 164 (77.40%) top management was seriously considering adopting a cloud computing system in their organisation (M=3.89, Std Deviation = 0.780).

It was also established that about 172(81.10%) respondents agreed/strongly agreed that it was the top management that wielded managerial prerogatives to provide resources that support the adoption of cloud computing (M=4.02, Std Deviation =0.863). About 199 (93.90%) intimated that the decision to adopt cloud services in their organisation depended on top management (M=4.29, Std Deviation= 0.680).

The findings on top management support summed up to a mean of at 3.95 (nearly 4) and a standard deviation of 0.790 indicating a degree of agreement in SMEs' perception of the impact of TMS to adopt cloud computing.

Table 6-15: Size of Organisation construct

	Size of Organisation (SO)		**Strongly Disagree/ Disagree**	**Neutral**	**Strongly Agree/ Agree**	**Mean**	**Std. Deviation**
SO1	The number of employees in my organisation is high compared to others in the industry.	Count	127	39	46	2.56	0.93
		Row N %	59.90%	18.40%	21.70%		
SO2	Small organisations are more flexible in adopting cloud computing.	Count	30	26	156	3.74	0.922
		Row N %	14.20%	12.30%	73.60%		
SO3	The revenue of my organisation is high compared to others in the industry.	Count	75	79	58	2.90	0.848
		Row N %	35.40%	37.30%	27.40%		
SO4	Bigger organisations with larger resources can easily move to adopt cloud computing.	Count	6	13	193	4.18	0.665
		Row N %	2.80%	6.10%	91.00%		
SO5	The size of an organisation impacts its adoption of cloud computing.	Count	7	18	187	4.24	0.742
		Row N %	3.30%	8.50%	88.20%		
OVERALL						3.52	0.821

Firm size is among the factors that influence technical innovation (Ayong and Naidoo, 2019; Widyastuti and Irwansyah, 2017). Some studies have shown that larger organisations have a large resource deposit and a diverse accumulation of assets hence can adopt new technology faster than small businesses, while others argue that small businesses are flexible enough to adopt any technology faster than large organisations (Lu et al., 2019; Widyastuti and Irwansyah, 2017). This study sought to find out the importance of firm size in adopting cloud computing in Zimbabwe.

Table 6.15 above shows the descriptive statistics of the size of the organisation construct. The analysis shows that two out of the five items in the construct have negative responses towards the impact of the size of organisation in cloud computing adoption as shown by the mean scores below 3. 127 (59.9%) of the respondents disagreed/strongly disagreed with item SO1, 'The number of employees in my organisation is high compared to others in the industry ', and 75 (35.4%) disagreed/strongly disagreed with item SO3 'The revenue of my organisation is high compared to others in the industry.' 79 (37.3%), a considerable number of respondents answered neutrally for item SO3 'The revenue of my organisation is high compared to others in the industry '. A large number of 193 (91%) positively affirmed that bigger organisations with more extensive resources could quickly adopt cloud computing (item SO4). In comparison, 187 (88.2%) agreed/strongly agreed that the size of an organisation impacts its ability to adopt cloud computing (item SO5). The analysis in Table 6.15 shows that the percentage of responses are spread across the 5-point Likert scale. However, the overall mean score of 3.52 and standard deviation of 0.821 indicate a degree of agreement in SMEs' perception on the impact of the size of organisation in cloud computing adoption.

Table 6-16: IT Knowledge of Employees construct

	IT Knowledge of Employees (IKE)		**Strongly Disagree/ Disagree**	**Neutral**	**Strongly Agree/ Agree**	**Mean**	**Std. Deviation**
IKE1	The IS staff in my organisation can support cloud computing systems development.	Count	23	13	176	3.91	0.906
		Row N %	10.80%	6.10%	83.00%		
IKE2	Organisations with employees who have more knowledge about cloud computing are likely to adopt it.	Count	1	7	204	4.25	0.558
		Row N %	0.50%	3.30%	96.20%		
IKE3	The level of knowledge about cloud computing within the organisation is low.	Count	16	12	184	4.15	0.883
		Row N %	7.50%	5.70%	86.80%		
IKE4	All my employees have basic knowledge about cloud computing.	Count	45	13	154	3.86	1.26
		Row N %	21.20%	6.10%	72.60%		
IKE5	All of my employees have already used cloud computing (personal use/ business purposes).	Count	132	37	43	2.47	0.966
		Row N %	62.30%	17.50%	20.30%		
IKE6	Having at least one employee who has a formal qualification in the use of cloud computing is important for my company.	Count	7	8	197	4.09	0.668
		Row N %	3.30%	3.80%	92.90%		
OVERALL						3.79	0.874

Research shows that one of the critical elements in adopting technology in an organisation is its repository of internal expertise or IT knowledge among the organisation's employees (Sallehudin et al., 2015). The same scholars argue that one of the IT adoption problems in organisations is the lack of IT knowledge among the employees. Thus, this study sought to understand IT knowledge in cloud adoption by SMEs in Zimbabwe.

Table 6.16 presents the frequency distribution of items measuring the IT knowledge of employees. The means range from the lowest M=2.47 (Std Deviation = 0.966) to the highest M=4.25 (Std Deviation 0.558). The lowest mean is for item IKE5- 'All my employees have already used cloud computing (personal use/ business purposes)', and the highest mean is for item IKE2- 'Organisations with employees who have more knowledge about cloud computing are likely to adopt it.' The results show that most respondents agreed/strongly agreed in five out of six items measuring this construct. 204 (92.2%) agreed/strongly agreed with item IKE2 'Organisations with employees who have more knowledge about cloud computing are likely to adopt it', 197 (92.9%) agreed/strongly agreed with item IKE6 'Having at least one employee who has a formal qualification in the use of cloud computing is important for my company'. The general trend apart from item IKE5 shows that most respondents agreed/strongly agreed with items in this construct. The summated mean score and standard deviation of 3.79 and 0.874 respectively seem to confirm further that most of the respondents agreed/strongly agreed to the impact of the IT knowledge of employees on the adoption of cloud computing by SMEs.

Table 6-16: Technological Readiness (TR)

	Technological Readiness (TR)		**Strongly Disagree/ Disagree**	**Neutral**	**Strongly Agree/ Agree**	**Mean**	**Std. Deviation**
TR1	Having a robust technical infrastructure (e.g., high bandwidth) would enable us to use cloud technology.	Count	20	14	178	3.88	0.823
		Row N %	9.40%	6.60%	84.00%		
TR2	Having a fast Internet connection would encourage us to adopt cloud technology.	Count	94	37	81	2.89	1.015
		Row N %	44.30%	17.50%	38.20%		
TR3	Having the necessary technical skills would enable us to use cloud technology	Count	84	44	84	2.96	1.018
		Row N %	39.60%	20.80%	39.60%		
TR4	We still lack in technical skills of using cloud technology in our organisation.	Count	17	16	179	4.24	0.92
		Row N %	8.00%	7.50%	84.40%		
OVERALL						3.49	0.944

Technological readiness is the availability of the correct IT infrastructure and the right skillset in the form of human resources that can positively influence cloud computing adoption (Nasser and Jawad, 2019; Yoo and Kim, 2019). Some studies argue that technological readiness should not only be measured by an organisation's ability to adopt new technology but should be reflected in the whole society, that is, consumer readiness, business partners readiness and the government so that any organisation that adopts the technology can reap maximum benefits from it (Kandil et al., 2018; Karim, 2018). The research sought to establish the importance of technology readiness in SMEs regarding SMEs' cloud computing adoption.

Four questionnaire statements (see Appendix B) measured the respondents' perception of the impact of technological readiness in cloud computing adoption in their organisations. The respondents had to rate their perceptions using a five-point Likert scale which ranged from 1 denoting "strongly disagree" to 5 denoting "strongly agree". The individual items mean scores ranged from the lowest M=2.89 (Std Deviation =1.015) to the highest M=4.24 (Std Deviation = 0.92) The highest mean was for item TR4 – 'We still lack in technical skills of using cloud technology in our organisation. (M= 4.24; Std Deviation = 0.92). This was followed by item TR1- 'Having a robust technical infrastructure (e.g., high bandwidth) would enable us to use cloud technology' (M= 3.88 Std Deviation =0.823). The lowest mean was for item TR2 – 'Having a fast Internet connection would encourage us to adopt cloud technology' (M= 2.89; Std Deviation = 1.015). In a nutshell, the results on technological readiness summed up to a mean of = 3.49 and standard deviation of 0.944 indicating a degree of agreement in SMEs perception on the importance of technological readiness (TR) to adopt cloud computing.

6.5.1 Descriptive statistics of environmental factors

Table 6-18: Government Regulations (GR)

	Government Regulations (GR)		Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
GR1	The government effectively promotes cloud computing adoption in SMEs.	Count	119	35	58	2.62	1.066
		Row N %	56.10%	16.50%	27.40%		
GR2	The data protection policies are regulated by the government.	Count	27	37	148	3.65	0.871
		Row N %	12.70%	17.50%	69.80%		
GR3	Government regulations can provide a better process for adopting cloud computing.	Count	21	23	168	3.83	0.824
		Row N %	9.90%	10.80%	79.20%		
GR4	Current government policy is focused on data privacy.	Count	89	59	64	2.84	1.048
		Row N %	42.00%	27.80%	30.20%		
GR5	Current government policy is focused on data security.	Count	84	61	67	2.90	1.037
		Row N %	39.60%	28.80%	31.60%		
GR6	There is no specific government policy on the adoption of cloud computing.	Count	5	31	176	4.27	0.814
		Row N %	2.40%	14.60%	83.00%		
OVERALL						3.35	0.943

Government regulations, including but not limited to friendly IT policies, available and affordable IT infrastructure, and some incentives, are essential to encourage SMEs to adopt cloud computing (Taylor, 2019). Some studies show that government regulations can either support or limit technology adoption (Widyastuti and Irwansyah, 2017; Alhammdi, 2016). This research sought to establish the importance of government regulations regarding SMEs' propensity to adopt cloud computing.

Table 6.18 shows that the means range from the lowest M=2.62 (Std Deviation = 1.066) to the highest M=4.27 (Std Deviation=0.814). The mean range shows the disparity in the way respondents responded to individual items in this construct. Three items, GR1 ‘The government effectively promotes cloud computing adoption in SMEs’ (M=2.62, Std Deviation=1.066), GR4 'Current government policy is focused on data privacy' (M=2.84, Std Deviation =1.048) and GR5 'Current government policy is focused on data security' (M=2.90; Std Deviation =1.037) have meant less than 3 implies that they disagreed with the statements. Seemingly from the items, the government might not be doing enough to promote the use of cloud computing in SMEs. However, on the other hand, three other items GR2 'The data protection policies are regulated by the government' (M=3.65, Std Deviation = 0.871), GR3 'Government regulations can provide a better process for adopting cloud computing' (M=3.83, Std Deviation=0.824) and GR6 (M=4.27, Std Deviation= 0.814) have meant greater than three (3) shows that respondents agreed to these statements.

Although respondents varied in how they responded to the items in this construct, the average mean score of the six items is 3.35 (above 3), and the standard deviation of 0.943 confirms that they agreed on the SMEs' perception of government regulations on cloud computing adoption.

Table 6-17: Competitive Pressure (COM)

	Competitive Pressure (COM)		Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
COM1	Our main competitors have adopted cloud computing.	Count	95	61	56	2.69	1.051
		Row N %	44.80%	28.80%	26.40%		
COM2	Our competitors who adopted cloud computing appear to have benefited greatly.	Count	81	72	59	2.79	1.015
		Row N %	38.20%	34.00%	27.80%		
COM3	I think that cloud computing influences competition in their industry.	Count	13	28	171	3.94	0.758
		Row N %	6.10%	13.20%	80.70%		
COM4	Our firm is under pressure from competitors to adopt Cloud Computing.	Count	103	59	50	2.69	0.971
		Row N %	48.60%	27.80%	23.60%		
COM5	Our competitors who adopted cloud computing appear to have benefited greatly.	Count	93	60	59	2.81	1.041
		Row N %	43.90%	28.30%	27.80%		
OVERALL						2.98	0.967

Competitive pressure is some competition that one SME is subjected to by other SMEs regarding market share within the same industry type (Cathurika, 2019; Gangwar, 2015). Competitive pressure from other SMEs can affect how the firm strategically positions itself and find a better business niche. Some SMEs take competitive pressures as an incentive to adopt new technologies and create new competitive business models (Prause, 2019). This construct sought to establish the importance of competitive pressure in adopting cloud computing by SMEs in Zimbabwe.

Competitive pressure was measured on a 5-point Likert scale. The items' means ranged from the lowest M= 2.69 (Std Deviation = 0.1.051) to the highest M=3.94 (Std Deviation = 0.758). The findings in Table 6.19 show that about 171 (80.7%) of the respondents agreed that cloud computing influences competition in their industry (M = 3.94, Std Deviation = 0.758) while the mean scores of four individual items COM1 (M=2.69, Std Deviation 1.051), COM2 (M=2.79, Std Deviation=1.015), COM4 (M=2.69, Std Deviation=0.971) and COM5 (M=2,81, Std Deviation=1.041) seem to negatively rate the influence of competitive pressure on cloud computing. Arguably the summed mean score at M=2,98 is marginally below three (3), showing that there were some variations in the way SMEs responded to some items in this construct. The majority disagreed, and at the same time, an equally large number of respondents agreed that indeed competitive pressure impacts cloud adoption.

Table 6-18: Information Intensity (II)

	Information Intensity (II)		Strongly Disagree/ Disagree	Neutral	Strongly Agree/ Agree	Mean	Std. Deviation
II1	The users and organisations in the same industries as my organisation rely on each other for information regarding services.	Count	54	19	139	3.39	1.05
		Row N %	25.50%	9.00%	65.60%		
II2	Users have access to sufficient information on how to use our services.	Count	107	38	67	2.74	1.019
		Row N %	50.50%	17.90%	31.60%		
II3	Organisations in the same sector as my organisation can access sufficient information to support a change in services provided.	Count	70	25	117	3.28	1.137
		Row N %	33.00%	11.80%	55.20%		
II4	My organisation is dependent on up-to-date information.	Count	8	11	193	4.09	0.643
		Row N %	3.80%	5.20%	91.00%		
II5	It is very important for my organisation to access information fast, whenever we need the information	Count	1	7	204	4.24	0.528
		Row N %	0.50%	3.30%	96.20%		
II6	My organisation needs to have access to reliable, relevant and accurate information.	Count	0	5	207	4.36	0.529
		Row N %	0.00%	2.40%	97.60%		
OVERALL						3.68	0.818

Information intensity in this study is defined as the extent of availability and easy accessibility of up-to-date, accurate, relevant and reliable information whenever the information is needed (Taylor, 2019). SMEs must be able to access important information on the go and whenever the information is required. This section of the study sought to establish the relation between information intensity and the intention to adopt cloud computing.

It is quite evident from Table 6.20 that five out of six items have more positive responses toward the impact of information intensity in cloud computing adoption. Thus, 207 (97.60%) of the participants agreed/strongly agreed that their organisations needed to have access to reliable, relevant and accurate information (item II6), thus casting a die on the importance of adopting cloud computing. Equally important, is that 204 (96.20%) of the respondents agreed/strongly agreed that it was important for their organisations to access information fast whenever the information was needed. The item with the lowest mean II2 'Users has access to sufficient information on how to use our services' (M=2.74, Std Deviation = 1.019) shows the present reality that users have no access to information products and services offered by SMEs. However, the summated mean score of information intensity was 3.68 (Std Deviation = 0.818), indicating some degree of agreement in SMEs' perception of information intensity (II) to adopt cloud computing.

Table 6-19: External Support (ES)

	External Support (ES)		**Strongly Disagree/ Disagree**	**Neutral**	**Strongly Agree/ Agree**	**Mean**	**Std. Deviation**
ES1	Our company receives excellent technical support from the cloud provider.	Count	152	27	33	2.04	1.072
		Row N %	71.70%	12.70%	15.60%		
ES2	Our company receives training on a scheduled basis from cloud providers.	Count	157	26	29	2.06	1.047
		Row N %	74.10%	12.30%	13.70%		
ES3	Cloud computing enables us to outsource IT services and focus on our competencies.	Count	13	24	175	3.91	0.815
		Row N %	6.10%	11.30%	82.50%		
ES4	Having sufficient support from the cloud provider would encourage us to use cloud technology.	Count	7	10	195	4.15	0.692
		Row N %	3.30%	4.70%	92.00%		
ES5	Our cloud service provider allows us to switch to another provider easily.	Count	58	80	74	3.13	1.066
		Row N %	27.40%	37.70%	34.90%		
OVERALL						3.06	0.938

This part set out to establish the effect of external support on the adoption of cloud computing among SMEs in Zimbabwe. According to Widyastuti and Irwansyah (2017), cloud computing adoption in SMEs can be influenced by the degree of support SMEs receive from service providers. The table above shows item means ranging from the lowest ES1 'Our company receives excellent technical support from the cloud provider' M=2.04 (Std Deviation = 1.072) to the highest ES4 'Having sufficient support from the cloud provider would encourage us to use cloud technology' M=4.15 (Std Deviation = 0.692). Items ES1 (M=2.04) and ES2 (M=2.06) show that respondents endorsed the lower end of the items' scale, that is, disagreed/strongly disagreed with the two items. The mean scores of the other four items, ES3, ES4 and ES5, are higher than three (3); thus, most respondents agreed/ strongly agreed with the statements. Consequently, the summated mean score of 3.06 and a standard deviation of 0.938 support SMEs' perception of external support to adopt cloud computing.

Table 6-20: Cloud Adoption construct (CD)

	Cloud Adoption (CD)		**Strongly Disagree/ Disagree**	**Neutral**	**Strongly Agree/ Agree**	**Mean**	**Std. Deviation**
CD1	I am willing to use cloud computing technology in my organisation.	Count	2	7	203	4.33	0.588
		Row N %	0.90%	3.30%	95.80%		
CD2	My organisation is committed to adopting cloud computing within the next 12 months	Count	66	57	89	3.11	1.051
		Row N %	31.10%	26.90%	42.00%		
CD3	I am currently using cloud computing in my business.	Count	136	36	40	2.44	0.949
		Row N %	64.20%	17.00%	18.90%		
CD4	I have already adopted some cloud computing services.	Count	131	30	51	2.53	1.004
		Row N %	61.80%	14.20%	24.10%		
CD5	The organisation is currently engaged with cloud computing adoption.	Count	130	31	51	2.51	1.023
		Row N %	61.30%	14.60%	24.10%		
CD6	My organisation will likely take steps to adopt cloud technology in the future.	Count	5	11	196	4.28	0.692
		Row N %	2.40%	5.20%	92.50%		
OVERALL						3.20	0.885

Table 6.22 shows six items used to measure the extent to which SMEs have adopted or willing to adopt cloud computing. The mean scores of items ranged from the lowest of M=2.51 (Std Deviation 0.588) to the highest of M=4.33 (Std Deviation = 0.588). 203 (95.80%) respondents agreed/strongly agreed that they were willing to adopt cloud computing in their organisation, 196 (92,50%) agreed/strongly agreed that their SMEs were likely to take steps to adopt cloud technology in the future. On the lower end of the Likert scale, 131 (61.8%) and 130 (61.30%) disagreed/strongly disagreed that they had adopted cloud computing or engaged with cloud computing, respectively. However, the summated overall mean is above three, indicating some degree of agreement in SMEs' perception of cloud adoption.

6.5.1.1 *Summary of Descriptive Statistics*

To summarise, this section highlighted descriptive statistics. It explained the collected data's essential characteristics using frequency counts, percentages, means and standard deviations. Descriptive statistics were discussed under four headings: technological, organisational, environmental and cloud computing adoption factors derived from the DOI and TOE technological frameworks. The technological factors result showed that respondents agreed/strongly agreed that relative advantage, compatibility, security, complexity, and trialability affect Zimbabwean SMEs' cloud computing adoption. The overall results for organisation factors indicated that respondents either agreed or strongly agreed that top management's support, size of the organisation, IT knowledge of employees, and technological readiness influence SMEs' cloud computing adoption in Zimbabwe.

Furthermore, the respondents also agreed/strongly agreed that these environmental factors, government regulations, competitive pressure, information intensity and external support influence cloud adoption by SMEs in Zimbabwe. However, it is also important to note that there was almost an even split between respondents who agreed and those who disagreed on the influence of competitive pressure in cloud computing adoption by SMEs in Zimbabwe. The following section outlines the results from inferential statistics.

6.6 EXPLORATORY FACTOR ANALYSIS

In this study, EFA was conducted to measure construct validity. Construct validity measures the extent to which an instrument accurately measures a theoretical construct that it is designed to measure (N. H. M. Ghazali, 2016).

Before performing EFA, Kaiser-Meyer-Olkin (KMO) and the Bartlett test for sphericity were checked. The first test was to perform a sampling adequacy test (to check if the sample size was adequate for the study) using the Kaiser-Meyer-Olkin (KMO) measure, followed by the Bartlett test for sphericity, then Exploratory Factor Analysis (EFA) and finally reliability checks. These different tests are explored below.

KMO is a technique used to check the sample size, whether the sample size is adequate to perform factor analysis. Goud and Puranik (2016) describe KMO as a measure of sampling adequacy, which is used to determine the appropriateness of factor analysis. KMO index ranges from 0 to 1 (Pallant, 2020). The following scales are commonly used to determine the appropriateness of subjecting the collected data to factor analysis; a value between 0.5 and 0.7 are classified as average; 0.7 and 0.8 are good; 0.8 to 0.9 are great, and those above 0.9 are excellent (Awabil and Anane, 2018; Pallant, 2020).

The Bartlett test of sphericity measures the test existence of significant correlations between the variables (Pallant, 2020). A statistically significant ($p<0.05$) indicates that enough correlations exist among the Likert scale statements to continue with factor analysis (Bartlett', 1954). Three different EFA was performed, and these fall under technological, organisational and environmental factors. The following section explains how each of these was carried out in this study.

6.6.1 Technological Factors

Two statistical tests were performed to check the suitability of data for EFA. These are the KMO and Bartlett test of sphericity.

Table 6-23: KMO and Bartlett's Test for Technology factors

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.881
Bartlett's Test of Sphericity	Approx. Chi-Square	4493.997
	Df	325
	Sig.	.000

KMO was calculated and yielded 0.881, as shown in Table 6.23. This value is referred to as meritorious (Hair et al., 2014) because it is well above the minimum acceptable limit of 0.6 (Tabachnick and Fidell, 2007). The second statistical test was the Bartlett test of sphericity. This test shows the existence or non-existence of sufficient correlations among the variables (items) to proceed with EFA (Goud and Puranik, 2016). The Bartlett test of sphericity must be significant ($p<0.05$) for EFA to be considered suitable. Table 6.23 shows the Bartlett sphericity test at 0.000, which is less than 0.05 making it statistically significant at 95% confidence level (Awadil and Anne, 2018). Thus, the result shows the existence of sufficient correlation among the variables (items) to proceed with EFA (Goud and Puranik, 2016).

6.6.1.1 *Factor Extraction and Rotation*

After meeting the criteria for EFA (KMO and Bartlett tests), 31 items making the Technological factors were subjected to principal component analysis (PCA) with varimax rotation using SPSS version 26 (IBM Corp, 2019). Table 6.24 shows an initial analysis that obtained eigenvalues for each factor for the technology factors items.

Table 6-21: Total Variance Explained

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.413	36.203	36.203	9.413	36.203	36.203	4.283	16.473	16.473
2	4.195	16.134	52.337	4.195	16.134	52.337	3.595	13.828	30.302
3	2.403	9.241	61.578	2.403	9.241	61.578	3.457	13.296	43.598
4	1.639	6.302	67.880	1.639	6.302	67.880	3.410	13.117	56.715
5	1.039	3.995	71.875	1.039	3.995	71.875	2.500	9.616	66.331
6	1.002	3.854	75.729	1.002	3.854	75.729	2.443	9.398	75.729
7	.778	2.992	78.721						
8	.715	2.749	81.470						
9	.587	2.257	83.726						
10	.550	2.117	85.843						
11	.453	1.743	87.586						
12	.402	1.545	89.132						
13	.349	1.343	90.475						
14	.332	1.275	91.750						
15	.308	1.183	92.933						
16	.296	1.138	94.072						
17	.248	.953	95.025						
18	.219	.843	95.868						
19	.208	.801	96.669						
20	.179	.687	97.356						
21	.177	.682	98.038						
22	.130	.500	98.538						
23	.107	.413	98.951						
24	.101	.387	99.339						
25	.094	.361	99.700						
26	.078	.300	100.000						
Extraction Method: Principal Component Analysis.									

Kaiser criterion recommends that factors (components) with eigenvalues greater than one are retained for further investigation (Awadil and Anne, 2018; Yahya et al., 2017). Using Kaiser's criterion (latent root), only six components, as shown in Table 6.24, have an Eigenvalue greater than one (1). The remaining components have eigenvalues less than one and are considered insignificant; therefore, must be disregarded (Tehrani and Shirazi, 2014).

The total variance explained of the combined six factors was 75.729% exceeding the commonly recommended minimum threshold of 60% (Hair et al., 2010). The above table also shows how different factors contributed to the total variance explained. Each of the retained six factors contributed the following to the total variance explained.

Factor one contributed 36.203% of the total variance explained, factor two accounted 16.134%, factor three explained 9.241%, factor four contributed 6.302%, factor five contributed 3.995%, and lastly, factor six contributed 3.854% to the total variance explained.

Scree Test Criterion is another method that can be used to consider the number of factors that can be retained. Research recommends combining the Kaiser criterion and examining the scree plot when deciding the number of factors (Osborne et al., 2014) to extract in EFA. The Scree test recommends retaining all factors found before the bend or "elbow" where the curve's slope flattens (Osborne et al., 2014). However, some researchers recommend extracting the number of factors ranging from one to two factors above the elbow to one or two below (Yahya et al. 2017; Osborne et al., 2014).

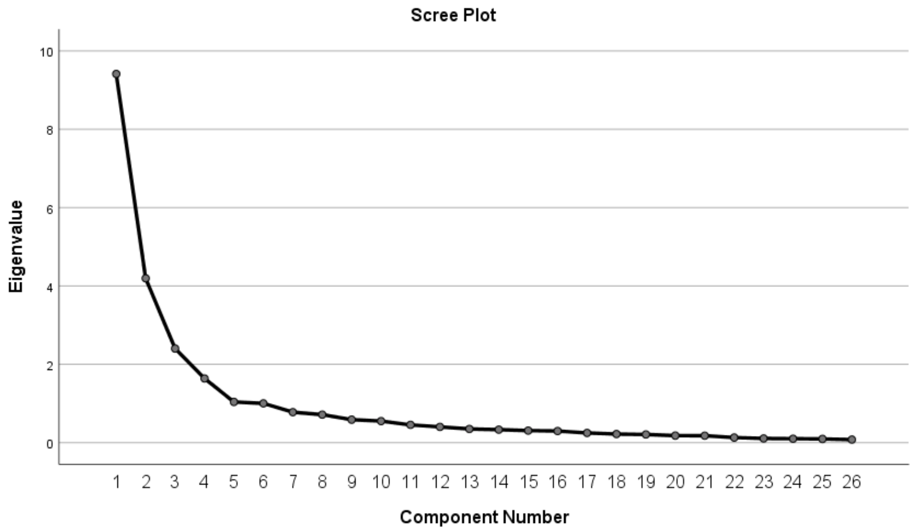

Figure 6-4: Scree Plot for retained factors

A careful inspection of the plots in Figure 6.4 shows six factors just before the 'elbow' bend that were retained for further investigation. These six factors were called relative advantage, complexity, security, trialability, cost and compatibility as theoretically conceptualized in the questionnaire. These factors are discussed in the following section.

6.6.1.2 *Factor Rotation and Interpretation*

After identifying the number of retained factors, the next step involves interpreting the grouped data set (Yahya et al., 2017). Factor Rotation helps to "clarify the factor structure and make the results of your EFA most interpretable" (Osborne, 2014:8).

The twenty-six items measuring technological constructs were rotated according to the Varimax rotation method. Besides being commonly used, Varimax (orthogonal) rotation was chosen for this study because it produces more easily interpretable clusters of factors (Osborne and Costello, 2009). Additionally, Varimax rotation maximises the dispersion of loadings among factors; hence it attempts to minimise the number of variables with high loadings for each factor (Senarathna et al., 2016).

Table 6.25 shows the factor loadings of technological factor items. According to Hair, et al., (2010) factor loading of at least 0.50 shows that items load firmly on their associated factors. Based on Hair et al., (2010) observation, 0.5 was used as the threshold to ensure the retained items (variables) are of practical significance for further analysis. The results show that there no cross-loading, thus supporting discriminant validity.

Table 6-22: Technological factors Rotated Component Matrix

Rotated Component Matrix						
	Component					
	1	2	3	4	5	6
RA3	.889	.137	-.009	.241	-.088	.019
RA2	.838	.130	.008	.212	-.083	.000
RA4	.809	.121	.007	.242	-.120	-.021
RA5	.804	.202	.024	.249	-.122	-.073
RA1	.760	.093	.041	.190	-.137	.067
CX1	.142	.826	-.132	.217	-.226	-.192
CX2	.165	.812	-.141	.261	-.197	-.178
CX4	.153	.744	-.087	.218	-.125	-.248
CX5	.312	.619	-.017	.356	-.371	-.070
CX3	-.152	-.573	.173	-.172	.369	.171
S2	.027	-.130	.907	.043	.100	.056
S1	-.059	-.089	.906	-.050	.140	.012
S3	.030	-.093	.901	.013	.075	.102
S4	.037	-.045	.855	.048	-.089	.104
C2	.221	.197	.079	.785	-.155	.096
C5	.286	.219	-.040	.774	-.125	-.104
C1	.291	.192	.049	.731	-.168	.094
C4	.417	.093	-.009	.675	-.100	-.102
C3	.275	.342	.008	.580	-.306	-.001
T3	-.076	-.243	.191	-.135	.816	.044
T2	-.266	-.313	.021	-.307	.762	.191
T1	-.318	-.301	.029	-.320	.724	.163
CP3	-.020	-.236	.062	-.041	.123	.861
CP4	.014	-.321	.100	-.109	.095	.847
CP1	-.181	-.429	-.055	.229	-.096	.593
CP2	.195	.129	.361	.049	.196	.574
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 7 iterations.						

As indicated in Table 6.25, the Rotated Component Matrix shows that six factors were extracted, and their contributions are explained below.

Factor one consisted of five items that contributed 36.203% of the score variance to the total variance explained. The items are for relative advantage scores from the technological dimension of the conceptual model with factor loadings ranging from 0.760 to 0.889, and consequently, the factor retained "Relative Advantage" as its title. All the factor loadings are above 0.5 strongly loading to the construct they are supposed to measure (Osborne and Costello, 2009). The factor comprised of the following items

- RA1 Adopting cloud computing would allow us to use the latest version of the technology,
- RA2 Using cloud computing would allow better communication with our suppliers and customer,
- RA4 Using cloud computing would make it easier for us to do our job, and
- RA5 Cloud computing would enhance our company's data storage capacity.

Factor two contained five items which accounted for 16.134% of the variance to the total variance explained. The items are complexity scores from the conceptual model's technological dimension with factor loadings ranging from -0.573 to 0.826, strongly loadings above the recommended 0.5. Items in this factor described the complexity of adopting cloud computing and items describing this factor are:

- CX1 Working with cloud computing is complicated, and it is difficult to understand what is going on,
- CX2 It takes too long to learn how to use cloud computing to make it worth the effort,
- CX3 Learning to operate the cloud computing system is easy for me,
- CX4 It takes too much time for me if I want to use cloud computing to do my normal duties and
- CX5 In general cloud computing is very complex.

Consequently, as a result of high factor loading Factor 2 retained its name as "Complexity."

Factor three, which consisted of four items, contributed 9.241% of the total variance. The factor loadings ranged from 0.855 to 0.907 well above the recommended 0.5, showing that strong loadings are indeed measuring the security construct under the technological dimension. The items describing factor three were loaded as:

- S2 Using cloud computing system solutions are trustworthy,
- S1 Cloud computing provides a sufficient security transfer channel during the process of mass data interchange,
- S3 Cloud provider data centres provide greater security of data, and

- S4 Cloud provider data centres have effective backup systems. The four items in Factor 3 retained “Security” as its title in the next stage of data analysis.

Factor four consisted of five items that accounted for 6.302% of the total variance explained. The items measured the cost construct under technological factors. The loadings range from 0.580 to 0.785 above the 0.5 thresholds, showing a strong loading for cost construct. The items loaded as:

- C2 Cloud computing eliminates the cost of upgrading the IT system in our organisation, C5 Cost of high bandwidth and availability of the Internet will be an issue for my organisation's decision to adopt cloud computing,
- C1 Cloud computing decreases the investment in new IT infrastructure in our organisation,
- C4 Costs of using the Internet are very high in Zimbabwe and
- C3 Deploying cloud computing involves high costs.

Factor four kept "Costs" its name in further data processing due to high factor loadings.

Factor five comprised three items that accounted for 3.995% of the total variance explained. The factor loading ranged from 0.724 to 0.816 well above the recommended 0.5, thus loading strongly for the trialability construct under the cloud computing adoption model and evidence supporting that trialability affects cloud computing adoption. The items that measured the trialability construct were:

- T3 Cloud computing is available to me to adequately test run various applications,
- T2 I am permitted to use cloud computing on a trial basis for long enough to see what it could do and
- T1 I have a great deal of opportunity to try various types of cloud computing.
- There was no name change; hence factor five retained "Trialability" as its name.

Factor six contained four items that contributed 3.854% to the total variance explained. Originally the compatibility construct contained six items of which two items irrelevant in measuring compatibility and consequently were deleted. The four items' loading ranged from 0.574 to 0.861, showing a strong loading for compatibility construct in the cloud adoption framework. The factor retained its name as "Compatibility" in further data analysis.

The individual items had the following loadings:

- CP3 Using cloud computing is compatible with our company's business model (0.580),
- CP4 Using cloud computing fits well into our company's work style (0.675),
- CP1 Cloud computing is NOT compatible with other systems that we are using (0.731),
- CP5 Using cloud computing fits well into our company's work style (0.774) and
- CP2 Cloud computing can easily be integrated into our existing IT infrastructure (0.785).

6.6.1.3 *Summary of Technological Factors*

To summarise, it is evident from the above results that all six technological factors loaded strongly with factor loadings above the minimum recommended threshold of 0.5 (Hair et al., 2010). Factor one (relative advantage, RA) accounted for 36.203% of the total variance explained with individual factor loadings that ranged from 0.760 to 0.889. This was followed by factor two (complexity, CX), which contributed 16.134% to the total variance explained, and individual factor loadings ranged from -0.573 to 0.826. the other four factors' contributions to the total variance explained are as follows: factor three (security, S) contributed 9.241% of the total variance explained, with individual factor loadings that ranged from 0.855 to 0.907. Factor four (costs, C) accounted for 6.302% of the total variance explained and individual factor loadings ranging from 0.580 to 0.785. Factor five (trialability, T) contributed 3.995% of the total variance explained with factor loadings that ranged from 0.724 to 0.816. Lastly, factor six (compatibility, CP) accounted for 3.854% of the total variance explained with factor loadings ranging from 0.574% to 0.861%. It is clear from the above results that all factor loadings were above the minimum threshold of 0.5 (Hair et al., 2010); thus, all factors were retained for further analysis.

The next section will discuss the other two dimensions, Organisational factors and Environmental factors, to complete the three significant dimensions of the cloud adoption framework. The two dimensions were subjected to the same statistical tests as the Technological factors above.

6.6.2 Organisational Factors

Two statistic tests were conducted on organisational items to check the suitability of data for EFA, and these were the KMO and Bartlett test of sphericity. Twenty factors for organisational factors were subjected to PCA with varimax rotation using SPSS version 26. Table 6.26 shows the KMO and Bartlett's test of sphericity.

Table 6-26: KMO and Bartlett's test of Organisational factors

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.763
Bartlett's Test of Sphericity	Approx. Chi-Square	1146.876
	df	66
	Sig.	.000

Table 6.26 shows that KMO is 0.763 above the recommended 0.6 (Hair et al. 2010); thus, the sample size was sufficient for EFA. The second statistic, Bartlett's test, has a value of 0.000 which is considered appropriate for EFA. EFA was conducted, and the result is shown in Table 6.27. Convergent validity is demonstrated on items that loaded strongly to the factor.

Table 6-23: Total Variance Explained Organisational factors

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.185	34.875	34.875	4.185	34.875	34.875	2.887	24.062	24.062
2	1.835	15.293	50.168	1.835	15.293	50.168	1.936	16.135	40.197
3	1.547	12.890	63.058	1.547	12.890	63.058	1.925	16.038	56.235
4	1.048	8.734	71.792	1.048	8.734	71.792	1.867	15.557	71.792
5	.788	6.568	78.361						
6	.695	5.793	84.154						
7	.462	3.847	88.001						
8	.392	3.270	91.271						
9	.374	3.113	94.384						
10	.337	2.806	97.190						
11	.230	1.914	99.105						
12	.107	.895	100.000						
Extraction Method: Principal Component Analysis.									

There were twenty items in the original instrument, and after EFA, they were trimmed to twelve because some factors proved to be insignificant and deleted. The deleted items were TMS3, TMS5, SO4, SO5, TR1, TR4, IKE1, IKE4 and IKE5. Only components with eigenvalues greater than one (1) would be retained for further investigation. Table 6.27 shows that there are four factors retained for further analysis. The total variance explained was 71.792% above the minimum of 60 to 70% as recommended by Hair et al., (2014). Factor 1 contributed 34.875% of the total variance, Factor 2 explained 15,293%, Factor 2 accounted 12.890%, and finally, Factor 4 contributed 8.734% to the total variance explained.

The Scree plot, as shown in Figure 6.5 below, also confirms that only four factors were retained for further investigation.

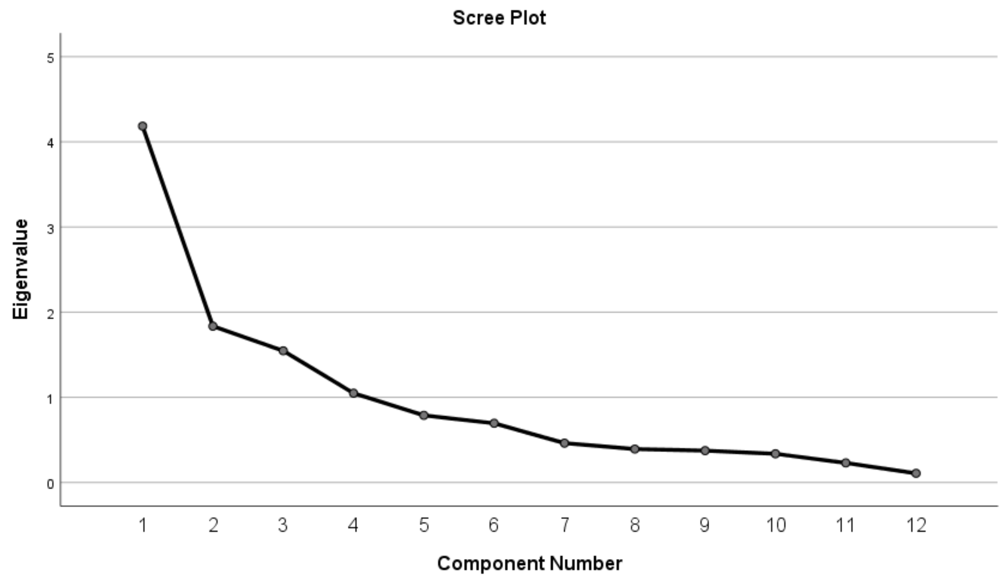

Figure 6-5: Scree Plot Organisational Factors

By carefully inspecting the plots and considering the recommendation by Osrbone (2014) to count one or two factors above and below the bend, Figure 6.5 shows four factors were retained for further analysis.

After identifying the factors to be retained, the next step was factor rotation. Varimax rotation method was selected because as mentioned before under technological factors, it minimises the number of variables and provides a more straightforward interpretation of the grouped factors (Senarathna et al. 2016; Osborne, 2014). The results of rotation are shown in Table 6. 28 below.

Table 6-24: Rotated Component Matrix Organisational factors

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
TMS1	.826	-.121	.117	-.041
TMS2	.815	.012	.074	.007
TMS3	.813	-.089	.217	.153
TMS4	.789	-.138	.296	.126
TR3	-.093	.934	-.205	-.092
TR2	-.135	.928	-.203	-.110
IKE2	.196	-.161	.819	.020
IKE3	.079	-.280	.805	.063
IKE6	.220	-.024	.587	.121
SO3	.054	-.078	.053	.878
SO1	-.064	.000	.146	.857
SO2	.362	-.220	.002	.529
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 5 iterations.				

As indicated in the total variance explained table and scree plot graph, four factors were extracted. The highlighted numbers indicate the retained items under each factor (component).

Factor one consisted of four items that contributed 34.875% to the total variance explained. The items measured top management support (TMS) construct in the organisational factors dimension. The factor loadings range from 0.789 to 0.826, showing a strong loading of the TMS construct in the organisational factors dimension of the cloud computing adoption model. The items in factor one loaded as TMS1 Top management is willing to take risks (financial and organisational) involved in adopting cloud computing (0.826); TMS2 Top management understands the benefits of cloud computing in our organisation (0.815); TMS3 Top management is seriously considering the adoption of an appropriate cloud system in my organisation (0.813) and TMS4 Top management provides resources to support the adoption of cloud computing (0.789). Due to high factor loadings, this factor did not change its name and remained "Top Management Support."

Factor two originally contained four items, but due to low loadings and maybe as well as cross-loadings, only two items were retained. Factor two accounted for 15.293 of the variances on the items. The two items loaded for Factor 2 were:

- TR3 'Having the necessary technical skills would enable us to use cloud technology' and
- TR2 'Having the necessary technical skills would enable us to use cloud technology.'

The factor loadings were 0.934 and 0.928 respectively showing a very strong loading to the top management support construct, well above the threshold of 0.5. Factor 2 retained its title "Technological Readiness."

Factor three, which consisted of three items, contributed 12.890% of the total variance explained. The loading for the three items ranged from 0.587 to 0.819. The items of this factor described how the IT knowledge of employees affects cloud adoption in SMEs. The items in this factor were:

- IKE6 'Having at least one employee who has a formal qualification in the use of cloud computing is important for my company (0.587)',
- IKE3 'The level of knowledge about cloud computing within the organisation is low (0.805)' and
- IKE2 'Organisations with employees who have more knowledge about cloud computing are likely to adopt it (0.819)'. Owing to high factor loadings, factor three retained the title "IT Knowledge of Employees" for further analysis.

Factor four contained three items that accounted for 8.734% of the total variance explained. The factor loadings of the items ranged from the lowest 0.529 to the highest 0.878. The loadings are above the recommended 0.5, making the loading strong enough to measure the effect of size of an organisation in cloud adoption. This factor comprised items as (from lowest to highest):

- SO2 'Small organisations are more flexible in adopting cloud computing (0.529)',

- SO1 ‘The number of employees in my organisation is high compared to others in the industry (0.857)’ and
- SO3 ‘The revenue of my organisation is high compared to others in the industry (0.878)’.

All three items retained the name “Size of Organisation” for further data analysis.

6.6.1.4 *Summary Ron Organisational Factors*

To summarise, it is evident from the above results that all the four factors loaded strongly showing a practical significance for further analysis. All the strongly loading items were above the recommended threshold of 0.5, thus showing the need for further analysis. The results showed that factor one loaded strongly on four items with loadings ranging from 0.789 to 0.826, contributing 34.875% of the total variance explained while factor two had loadings ranging from 0.934 and 0.928 and accounted for 15.293% total variance explained. Factors three and four also loaded strongly with loadings above the threshold of 0.5. Factor three items loadings ranged from 0.587 to 0.819 and accounted for 12.890% of the total variance explained. Lastly, factor four items loadings ranged from 0.529 to 0.878, contributing 8.734% to the total variance explained. The next section discusses the environmental factors.

6.6.2 **Environmental Factors**

As previously done in technological and organisational factors, two statistic tests were performed on environmental items to check their suitability to conduct EFA. The two tests KMO and Bartlett test of sphericity, were conducted on the items. Twenty environmental factors were subjected to PCA with varimax rotation using SPSS version 26 (IBM Corp, 2019). Table 6.29 shows the KMO and Bartlett’s test of sphericity.

Table 6-25: KMO and Bartlett's Test Environmental Factors

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.750
Bartlett's Test of Sphericity	Approx. Chi-Square	2160.711
	df	136
	Sig.	.000

The KMO test for environmental factors was 0.750. According to Hair et al. (2014), a KMO index between 0.7 and 0.8 is considered good and therefore, the KMO test above supports the sampling adequacy, and it is worth conducting an EFA. As indicated in Table 6.28, the Bartlett test is at 0.000, which is statistically significant to perform EFA (Hair et al. 2014). Table 6.30 below shows the total variance explained of the environmental items.

Table 6-26: Total Variance Explained Environmental factors

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.359	25.641	25.641	4.359	25.641	25.641	3.371	20.459	20.459
2	3.315	19.500	45.140	3.315	19.500	45.140	2.919	15.310	35.770
3	2.176	12.797	57.938	2.176	12.797	57.938	2.520	13.272	49.041
4	1.323	7.783	65.721	1.323	7.783	65.721	2.303	12.342	61.384
5	1.153	6.783	72.504	1.153	6.783	72.504	2.020	11.120	72.504
6	.818	4.811	77.315						
7	.776	4.567	81.881						
8	.659	3.874	85.756						
9	.543	3.192	88.948						
10	.464	2.732	91.680						
11	.355	2.089	93.769						
12	.334	1.964	95.733						
13	.209	1.228	96.961						
14	.197	1.161	98.122						
15	.155	.909	99.031						
16	.088	.518	99.549						
17	.077	.451	100.000						
Extraction Method: Principal Component Analysis.									

Kaiser (1960) recommends retaining factors with eigenvalues of 1.0 or more for further analysis. Table 6.29 displays the eigenvalues and total variance explained for the seventeen extracted factors. The highest extracted eigenvalue is 4.359 while the lowest is 1.153, thus suggesting that only five factors have eigenvalues greater than one (1) and therefore can be retained for EFA. The total explained value for the six factors is 72.504% which is more than 10% of the recommended minimum (Hair et al. 2010).

The Scree Plot (Figure 6.6) also help to determine the number of factors to retain.

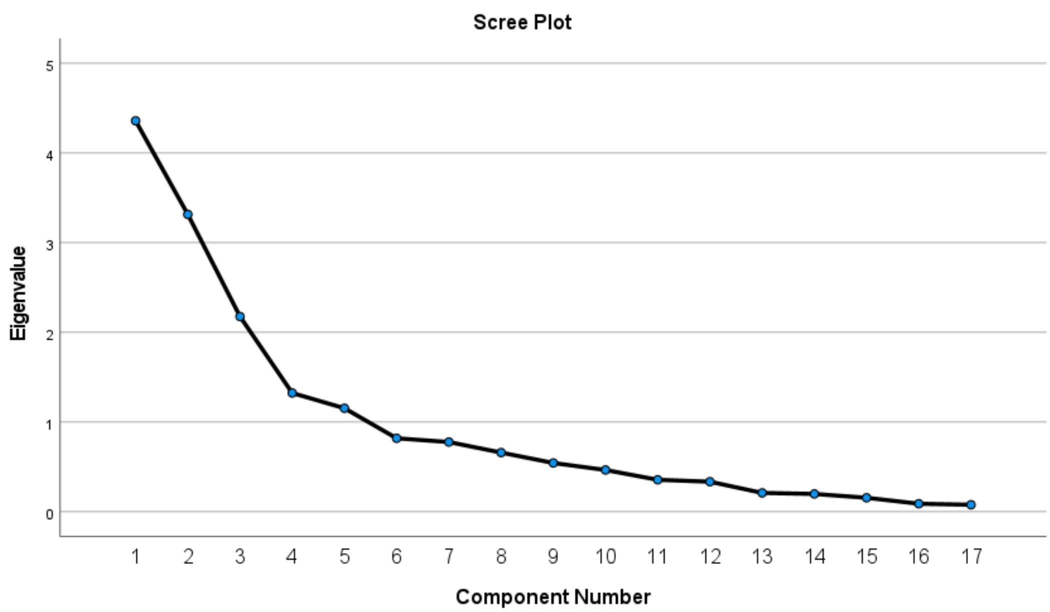

Figure 6-6: The Scree Plot Environmental factors

According to Osborne (2014), only the factors found before the bend or "elbow" where the slope of the curve flattens should be retained. Figure 6.6 shows five plots that appear above the bend, indicating that only five factors should be retained for further inspection.

The retained factors were rotated using the Varimax rotation method. Table 6.31 shows how factors were grouped after Varimax rotation.

Table 6-27: Rotated Component Matrix Environmental factors

Rotated Component Matrix					
	Component				
	1	2	3	4	5
COM2	.897	.025	.087	.226	-.083
COM5	.896	.092	.000	.105	.057
COM4	.893	.080	.053	.044	.062
COM1	.882	.052	.073	.252	-.036
II5	-.019	.782	.046	-.272	.275
II4	-.031	.767	-.026	-.154	.195
II6	-.053	.657	.023	-.330	.426
II3	.243	.630	-.014	.371	-.035
II1	.188	.625	.007	.247	-.114
GR5	.035	-.095	.942	.020	.029
GR4	.022	-.095	.929	.003	.092
GR1	.108	.205	.667	.089	-.078
ES1	.297	-.164	.145	.782	-.239
ES2	.302	-.123	.106	.781	-.177
ES5	.049	.166	-.090	.566	.376
ES4	.030	.079	.026	-.114	.826
ES3	-.014	.170	.020	-.003	.799
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 7 iterations.					

As indicated in Table 6.31 and Figure 6.6, five factors were extracted and retained for further investigation. The highlighted numbers show the items retained under each factor. The retained factors are explained below.

Factor one was measured by four items which accounted for 25.641% of the total variances. The individual factor loadings of the items ranged from 0.882 to 0.897. The factor loadings are above the recommended 0.5 showing that the items indeed measured the impact of competitive pressure as an environmental factor on an organisation's propensity to adopt cloud computing. Items measured the degree to which competitive pressure affects cloud computing adoption by SMEs. The items in this factor were:

- COM2 'Our competitors who adopted cloud computing appear to have benefited greatly (0.897)';
- COM5 'Our competitors who adopted cloud computing are favoured by our clients (0.896)',
- COM4 'Our firm is under pressure from competitors to adopt Cloud Computing (0.893)' and

- COM1 'Our main competitors have adopted cloud computing (0.882)'. Due to high factor loadings, this factor retained its title as "Competitive Pressure".

Factor two was made up of six items purporting to measure how information intensity impacts SMEs on cloud computing adoption. Five items loaded strongly and were retained. The five items accounted for 19.500% of the total variance. The factor loadings of the items ranged from 0.625 to 0.782. The items making this factor were:

- II5 'It is very important for my organisation to access information fast, whenever we need the information (0.782)'
- II4 ' My organisation is dependent on up-to-date information (0.767)',
- II6 'My organisation needs to have access to reliable, relevant and accurate information (0.657)',
- II3 'Organisations in the same sector as my organisation can access sufficient information to support a change in services provided (0.630)' and
- II1 'The users and organisations in the same industries as my organisation rely on each other for information regarding services (0.625)',

The factor retained its original name "Information Intensity" in further data analysis.

Factor three consisted of three items which accounted for 12.797% of the total variance. The items related to government regulations on cloud adoption by SMEs had factor loadings ranging from 0.667 to a high of 0.942. The high factor loadings indicate that the items were able to measure the government regulations construct which they were supposed to measure (Osborne and Costello, 2009). The three items that assessed this factor were:

- GR5 'Current government policy is focused on data security (0.942),
- GR4 'Current government policy is focused on data privacy (0.929)' and
- GR1 'The government effectively promotes cloud computing adoption in SMEs (0.654)'.

Factor four retained the title “Government Regulations” for further data investigation.

Factor four initially comprised five items purporting to measure the effect of external support on cloud adoption by SMEs in Zimbabwe. During the rotation, items were split according to their latent characteristics to make two new factors. The first factor with three items assumed a new name and is now called “External Support”. Meanwhile, the second factor consisting of two items is now factor five and attained a new name called “Outsource cloud-services”.

Factor four, as already mentioned above, comprised three items which accounted for 7.783% of the total variance explained. The loadings were above 0.5 which ranged from the lowest to the highest as ES5 'Our cloud service provider allows us to switch to another provider easily (0.566)', ES2 ‘Our company receives training on a scheduled basis from cloud providers (0.781)’ and ES1 ‘Our company receives excellent technical support from the cloud provider (0.782)’.

The items strongly loaded to the construct they intended to measure, which was external support. Subsequently, this factor retained the title "External Support" in further data investigation

Factor five, as already mentioned above, was a split from factor four and it acquired a new name “Outsource cloud-services”. The two items in this factor contributed 6.783% of the total variance explained. The items loaded strongly above the minimum cut-off of 0.5 (Hair et al. 2010). The items loaded as ES3 ‘ES3 'Cloud computing enables us to outsource IT services and focus on our competencies (0.799) and ES4 'Having sufficient support from the cloud provider would encourage us to use cloud technology (0.826).

6.6.2.1 *Summary of Environmental Factors*

To summarise, the above results show that factor one (competitive pressure, COM) loaded strongly and accounted for 25.641% of the total variances with individual factor loadings of the items ranging from 0.882 to 0.897. This was followed by factor two (information intensity, II), which accounted for 19.500% of the total variance. Items for factor two’s loadings ranged from 0.667 to 0.942. Factor three came third and contributed 12.797% to the total variance explained with factor loadings ranging from 0.667 to 0.942. Meanwhile, factor four (External support) occupied the fourth position with a contribution of 7.783% to the total variance explained with loadings between 0.566 to 0.82. Lastly, factor five (Outsourcing cloud-services) came fifth, having accounted for 6.783% of the total variance. The items for factor five had factor loadings ranging from 0.799 to 0.826.

It is also evident from the above results that relative advantage contributed the highest percentage, 36.203% to the total variance under technological factors, while top management support contributed 34.875% under organisational factors and finally under environmental factors, competitive pressure accounted for 25.641%. The following section discusses the cloud adoption factors.

The value of the KMO is about 0.816, which is greater than the acceptable range of 0.50 (Hair et al., 1995). Bartlett's Test of Sphericity is highly significant.

6.6.3 **Cloud Adoption Factors**

The two tests KMO and Bartlett test of sphericity were conducted on cloud adoption items and the results are indicated in the table below.

Table 6-32: KMO and Bartlett's Test Cloud Adoption

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.797
Bartlett's Test of Sphericity	Approx. Chi-Square	466.334
	df	6
	Sig.	.000

Table 6.32 shows the KMO and Bartlett's Test of Sphericity. The value of the KMO is about 0.797, which according to Hair et al. (2010), is considered good because it is greater than the acceptable range of 0.50. The Bartlett's Test of Sphericity is significant with a value $p<0.05$ (Tabachnick, Fidell, & Ullman, 2007). Thus, the provided data of the cloud adoption

construct is considered to be suitable for EFA. Table 6.33 below shows the total variance explained of the cloud adoption items.

Table 6-28: Total Variance Explained Cloud Adoption factors

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.834	70.840	70.840	2.834	70.840	70.840	2.834	70.840	70.840
2	.693	17.336	88.177						
3	.273	6.834	95.011						
4	.200	4.989	100.000						
Extraction Method: Principal Component Analysis.									

The table above indicates that there was only one component with an eigenvalue of 2.834 was extracted making the construct suitable for EFA. The extracted component explained 70.840% of the total variance. The screen plot below also confirms the results of eigenvalue, that only one factor was extracted.

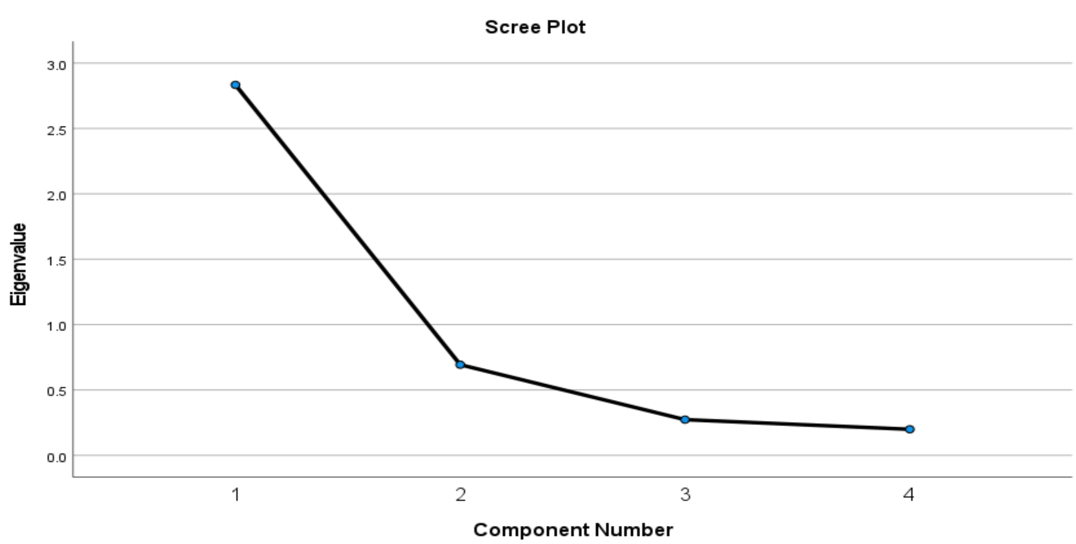

Figure 6-7: The Scree Plot Environmental factors

The retained factor was rotated using the Varimax rotation method. Table 6.34 shows how items were grouped after Varimax rotation.

Table 6-29: Rotated Component Matrix Cloud Adoption factors

	Component
	1
CD4	.904
CD3	.902
CD5	.891
CD2	.640
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	
Rotated Component Matrix	

Cloud adoption construct was made up of five items, but one item loaded poorly and was deleted retaining four items for further investigation. The items had factor loadings ranged from 0.640 to 0.904 above the 0.5 minimum threshold factors (Osborne, Costello, & Kellow, 2014). The items loaded strongly on the willingness of SMEs to adopt cloud computing. The items in this factor were identified as:

- CD4 ‘I have already adopted some cloud computing services (0.904),
- CD3 ‘I am currently using cloud computing in my business (0.902)’,
- CD5 ‘The organisation is currently engaged with cloud computing adoption (0.891)’ and
- CD2 ‘My organisation is committed to adopting cloud computing within the next 12 months (0.640).’

This factor will continue to use the title “Cloud Adoption” in further data analysis. The following section explains reliability measurements performed on the collected data.

6.7 RELIABILITY MEASUREMENT

Reliability is defined as the extent to which the measure of constructs is consistent and dependable (Bhattacherjee, 2012). It is the measure of the internal consistency of an instrument (Ghazali, 2016). According to Senarathna, (2016:104) reliability is "the ability of a measuring instrument to provide the same error-free result consistently…" over a variety of conditions in which the results should be obtained (Nunnally, 1978). A test is reliable if a repeat measurement made by it under constant conditions consistently produces similar meaningful results (Taherdoost, 2018). Essentially reliability is about the possibility of repeating or replicating research findings. Taherdoost (2018) emphasises that reliability testing is essential in research because it checks the internal consistency across the parts of a measuring instrument to determine if they can be depended on. High reliability refers to items of the scale measuring the same construct to 'hang together' (Robson, 2009). Hanging together is about the homogeneity of items of the scale (Hair et al. 2010).

Construct reliability reflects the internal consistency of the scale items measuring the same construct for the collected data (Hair et al., 2010) and Cronbach's Alpha was used to measure the construct reliability of the scale. Scales with validated constructs were tested separately, (technological factors, organisational factors and environmental factors) to measure the internal consistency among the data items. As shown in Tables 6.34, 6.35 and 6.36, the alpha coefficients for the three constructs ranged between 0.701 to 0.942, indicating a reasonable level of reliability (a > 0.70) (Hair et al. 2010).

Convergent validity is the extent to which indicators of a specific construct converge or share a high proportion of variance in common while discriminant validity is the extent to which a construct is genuinely distinct from other constructs (Hair et al. 2014). Content validity was established during the preparation and designing of the questionnaire using items already validated in the literature and adapting them to this study's objectives.

This study used a Likert type scale in the research instrument (questionnaire), and Gliem and Gliem (2003) argue that it is imperative to calculate and report reliability in studies that employ Likert type scales. The reliability testing was accomplished by computing the Cronbach's Alpha. Cronbach's Alpha is the most widely used statistical tool to measure the internal consistency of scales (reliability) (Heale and Twycross, 2015). Furthermore, Taherdoost (2018) advises the use of Cronbach's Alpha as the most appropriate measure of reliability, especially when using the Likert scales. The Cronbach Alpha Coefficient provides a test of the reliability of the items of a construct more specifically internal consistency. According to Hair et al. (2010), four categories show the extent of reliability of items on the Cronbach's Alpha measurement, and these are:

- Less than 0.50 classified as poor (less reliable)
- 0.50 to 0.69 classified as moderate reliability
- 0.70 to 0.89 classified as high reliability
- Above 0.90 classified as excellent.

Many studies recommend a threshold of Cronbach's Alpha value of 0.70 as an acceptable reliability level (Taherdoost, 2018; Pallant, 2020; Hair et al. 2010). According to Sekaran and Bougie (2016), the nearer the Cronbach's Alpha is to 1, the higher the internal consistency reliability.

Cronbach's Alpha coefficient was used in this study to measure the reliability of each of the constructs in the cloud adoption framework model. The results are highlighted in the following section, and the discussion of the results ensues below each table.

Table 6-30: Reliability Test for Technological factors

Construct /Factor	**Cronbach's Alpha**	**Number of items**
Relative Advantage (RA)	0.917	5
Compatibility (CP)	0.778	5
Security (S)	0.834	5
Complexity (CX)	0.909	4
Costs (C)	0.868	5
Trialability (T)	0.740	4

Table 6.35 shows the reliability test for technological constructs. It is apparent from the table that all constructs obtained Cronbach's Alpha values ranging from high (0.740) to excellent (0.917), exceeding the recommended 0.7 thresholds (Hair et al. 2010), thus indicating strong reliability across all the analysed constructs.

Table 6-31: Reliability Test for Organisational factors

Construct /Factor	**Cronbach's Alpha**	**Number of items**
Top Management Support (TMS)	0.862	5
Size of Organisation (SO)	0.705	5
Technological Readiness (TR)	0.942	2
IT Knowledge of Employees (IKE)	0.701	6

As shown in Table 6.36, the Cronbach's Alpha test shows values ranging from high (0.701) to excellent (0.942), and as suggested by Hair et al. (2010), all constructs obtained an accepted level of internal consistency and hence reliable constructs.

Table 6-32: Reliability Test for Environmental factors

Construct /Factor	Cronbach's Alpha	Number of items
Government Regulations (GR)	0.739	5
Competitive Pressure (CP)	0.852	5
Information Intensity	0.701	5
Outsource Cloud-services	0.712	2
External Support	0.909	2

It is evident from Table 6.37, that the Cronbach's Alpha values for all constructs in the model exceed the threshold value of 0.7 (Hair et al. 2010). and hence indicate a good internal consistency among the constructs in the environmental construct. According to Hair et al. (2010), the factors of any Cronbach's Alpha values between 0.70 to 0.89 are classified as highly reliable.

Table 6-33: Reliability Test for Cloud Adoption factors

Construct /Factor	Cronbach's Alpha	Number of items
Cloud Adoption (CD)	0.741	5

The Cronbach's Alpha value for cloud adoption was 0.741 above the recommended threshold of 0.70 (Hair et al. (2010). This high value implies that the items developed to measure cloud adoption construct were considered internally consistent and hence reliable to measure this construct.

6.8 CORRELATION ANALYSIS

Pearson correlation analysis was conducted to measure the relationship between the dependent variable and independent variables (technological, organisational factors). The analysis produces correlation coefficients that quantify the strength of the relationship between the dependent (cloud adoption) and independent variables in cloud adoption of

SMEs in Zimbabwe (Cohen et al. 2013). Correlation analysis was performed to explain if there is a reasonable, statistically significant relationship between the dependent and independent variables. According to Cohen et al. (2013) correlation coefficient (r) ranges from -1 to +1 ($-1 \leq r \leq 1$). A correlation coefficient of zero (0) means there is no relationship while a +1 shows a perfectly positive, strong relation relationship and a -1 shows a perfect negative strong relationship (Hair et al. 2014; Pallant, 2020). The negative sign (-) refers to the direction of the relationship; that is, it is an inverse type of relationship (Hair et al. 2014). This study uses Cohen et al. (2013) recommended guidelines to interpret the strength of relationships between variables:

- r = 0.10 to 0.29 means weak/ small
- r = 0.30 to 0.49 means medium/ moderate
- r = 0.50 to 1.0 means strong/ large.

Field (2013) suggests that any variables' correlation should be less than 1.0 to prevent multicollinearity. According to Pallant (2020), multicollinearity occurs when there is a high correlation between the independent variables. The following section displays the correlation matrix of technological, organisational and environmental factors used in this study.

Table 6-34: Correlations- Technological Factors

Correlations- Technological Factors								
		Relative_ Advantage	**Compatibility**	**Security**	**Complexity**	**Cost**	**Trialability**	**Cloud_ Adoption**
Relative_ Advantage	Pearson Correlation	1						
	Sig. (2-tailed)							
	N	212						
Compatibility	Pearson Correlation	-0.067	1					
	Sig. (2-tailed)	0.333						
	N	212	212					
Security	Pearson Correlation	0.009	.228**	1				
	Sig. (2-tailed)	0.894	0.001					
	N	212	212	212				
Complexity	Pearson Correlation	.435**	-.432**	-.167*	1			
	Sig. (2-tailed)	0.000	0.000	0.015				
	N	212	212	212	212			
Cost	Pearson Correlation	.623**	-0.064	-0.001	.581**	1		
	Sig. (2-tailed)	0.000	0.351	0.988	0.000			
	N	212	212	212	212	212		
Trialability	Pearson Correlation	-.450**	.3 03**	.185**	-.588**	-.590**	1	
	Sig. (2-tailed)	0.000	0.000	0.007	0.000	0.000		
	N	212	212	212	212	212	212	
Cloud_ Adoption	Pearson Correlation	-.327**	.313**	.188**	-.358**	-.365**	.520**	1
	Sig. (2-tailed)	0.000	0.000	0.006	0.000	0.000	0.000	
	N	212	212	212	212	212	212	212
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

Table 6.39 shows the following statistically significant correlation between the dependent variable (cloud adoption) and technological (independent variables).

There is a statistically significant (p-value < 0.05) correlation between Relative Advantage and the following: Complexity, $r = 0.435$, $p = 0.000$; Cost, $r = 0.623$, $p = 0.000$; Trialability, $r = -0.450$, $p = 0.000$ and Cloud Adoption, $r = -0.327$, $p = 0.000$.

The table above shows a statistically significant (p-value < 0.05) correlation between Compatibility and the following: Security, $r = 0.228$, $p = 0.001$; Complexity, $r = -0.432$, $p = 0.000$; Trialability, $r = 0.303$, $p = 0.000$ and Cloud Adoption, $r = 0.303$, $p = 0.000$.

There is a statistically significant (p-value < 0.05) correlation between Security and the following: Complexity, $r = -0.167$, $p = 0.015$; Trialability, $r = 0.185$, $p = 0.007$ and Cloud Adoption, $r = 0.188$, $p = 0.006$.

Complexity is statistically (p-value < 0.05) correlated to Cost, $r = 0.581$, $p = 0.000$; Trialability, $r = -0.588$, $p = 0.000$ and Cloud Adoption, $r = -0.358$, $p = 0.000$.

Trialability is statistically (p-value < 0.05) correlated to Cloud Adoption, $r = 0.520$, $p = 0.000$.

From Table 6.39, the correlation between the dependent variable and independent variables range from -0.365 to 0.520 showing, according to Cohen et al. (2013), a moderate to strong correlation. The correlation between the dependent variable and independent (technological) variables was strong enough to perform multilinear regression.

Table 6-35: Correlations- Organisational Factors

Correlations- Organisational Factors						
		Top_Management_ Support	**Size_of_ Organisation**	**Technological Readiness**	**IT_Knowledge of_Employees**	**Cloud_ Adoption**
Top_Management _ Support	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	212				
Size_of_ Organisation	Pearson Correlation	.234**	1			
	Sig. (2-tailed)	0.001				
	N	212	212			
Technological_ Readiness	Pearson Correlation	-.263**	-.246**	1		
	Sig. (2-tailed)	0.000	0.000			
	N	212	212	212		
IT_Knowledge_of _ Employees	Pearson Correlation	.403**	.234**	-.430**	1	
	Sig. (2-tailed)	0.000	0.001	0.000		
	N	212	212	212	212	
Cloud_Adoption	Pearson Correlation	-0.026	0.017	.435**	-.314**	1
	Sig. (2-tailed)	0.708	0.807	0.000	0.000	
	N	212	212	212	212	212
**. Correlation is significant at the 0.01 level (2-tailed).						

The following statistically significant correlations can be observed in Table 6.40 above:

- Top Management Support is statistically (p-value < 0.05) correlated to Size of Organisation, r = 0.234, p = 0.001; Technological Readiness, r = -0.263, p = 0.000; IT Knowledge of Employees, r = 0.403, p = 0.000.
- Size of Organisation is statistically (p-value < 0.05) correlated to Technological Readiness, r = -0.246, p = 0.000; IT Knowledge of Employees, r = 234, p = 0.001.
- Technological Readiness is statistically (p-value < 0.05) correlated to IT Knowledge of Employees, r = -0.430, p = 0.000 and Cloud Adoption, r = 0.435, p = 0.000, IT knowledge of Employees is statistically correlated to Cloud Adoption, r = 0.314, p = 0.000.

- The correlation between cloud adoption (dependent variable) and organisational factors (independent variables) and) is between -0.314 to 0.435 showing a moderate correction according to Cohen et al., (2013) guidelines of the strength of the correlation between variables. Thus, the correlation between the dependent variable (cloud adoption) and independent (technological) variables was strong enough to perform multilinear regression.

Table 6-36: Correlations-Environmental Factors

Correlations- Environmental Factors							
		Government Regulation	**Competitive Pressure**	**External_Sup port**	**Outsource_Cloud Services**	**Information_Intensity**	**Cloud_ Adoption**
Government_ Regulation	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	212					
Competitive_ Pressure	Pearson Correlation	.132	1				
	Sig. (2-tailed)	.056					
	N	212	212				
External_Sup port	Pearson Correlation	.016	.105	1			
	Sig. (2-tailed)	.814	.128				
	N	212	212	212			
Outsource_Cl oud Services	Pearson Correlation	.034	-.006	.812**	1		
	Sig. (2-tailed)	.619	.935	.000			
	N	212	212	212	212		
Information_ Intensity	Pearson Correlation	.019	.223**	.327**	.284**	1	
	Sig. (2-tailed)	.783	.001	.000	.000		
	N	212	212	212	212	212	
Cloud_Adopt ion	Pearson Correlation	.101	.398**	-.045	-.153*	-.088	1
	Sig. (2-tailed)	.142	.000	.510	.026	.201	
	N	212	212	212	212	212	212
**. Correlation is significant at the 0.01 level (2-tailed).							

Table 6.41 shows the correction between the dependent (cloud adoption) variable and independent (environmental factors) variables. The correlations between the independent variable are as follows:

There is a statistically significant (p-value < 0.05) correlation between Competitive pressure and Information Intensity r = 0.223, p = 0.001 and Cloud_Adoption r = 0.398, p = 0.001.

External Support is statistically (p-value < 0.05) correlated to Outsource_Cloud-Services r = 0.812, p = 0.000, Information Intensity r = 0.223, p = 0.001 and Cloud_Adoption r = -0.398, p = 0.000.

The correlation between the dependent variable (Cloud Adoption) and independent variables (Environmental Factors) is between 0.284 to 0.812 indicationg an overall strong relationship (Cohen et al. 2013). The strong correlation between the dependent and independent variables allows multilinear regression to be performed on the variables.

Many statistically significant correlations observed between dependent (Cloud Adoption) and independent variables are drawn from DOI and TOE frameworks (discussed in Chapter 4). The next section explains the relative effects of combining the independent variables on cloud computing through regression analysis. As shown in the three tables (Table 6.39, Table 6.40 and Table 6.41), the highest correlation value is 0.812, indicating that there was no correlation value higher than 0.9, and thus no risk for multicollinearity (Hair et al., 2014), therefore the constructs were found fit for regression analysis. The following section explains why MLR was used for this study.

6.8.1 Multi Linear Regression Analysis (MLR)

Multilinear regression analysis is used to determine the predictive power of several variables (Pallant, 2020). Hair et al. (2014) put it more succinctly when describing MLR as an analysis of the relationship between a single dependent variable and several independent variables. In this study, MLR was used to determine a relationship between a single dependent variable (cloud adoption) and several independent variables from technological, organisational and environmental contexts. Three multilinear regression analyses were conducted. The first step was to analyse the influence of technological factors (relative advantage, compatibility, security, complexity, cost and trialability) on cloud computing adoption by SMEs. Secondly, cloud adoption (dependent variable) was analysed against organisational factors (top management support, size of an organisation, technological readiness and IT knowledge of employees). Lastly, cloud adoption was analysed against environmental factors (government regulations, competitive pressure, Outsourcing cloud services, information intensity and external support).

Multilinear regression was appropriate for this part of the study to test the model fit and establish the models' predictive power in the criterion variable and subsequently answer SRQ4 to identify the most influential factors in an organisation's decision to adopt cloud computing technology in Zimbabwe. Besides, MLR explores the influence of independent variables on a dependent variable.

Before conducting MLR analysis, it is vital to satisfy certain assumptions that justify using multilinear regression analysis to predict the outcome of many variables (technological, organisational and environmental) on one independent variable (cloud adoption). The assumptions tested in each of the three MLR in this study included sample size adequacy, multicollinearity, normality, homoscedasticity, and outlier testing. These assumptions are described below.

6.9 TECHNOLOGICAL FACTORS

Two things must be verified to check if data are fit for MLR analysis. Firstly, data must be checked for statistical significance and secondly check if the data have not violated any

MLR assumptions. The following section discusses the two tests that must be carried out before the MLR analysis.

6.9.1 **Checking for the significance of the model**

The first step is to evaluate the model's significance by checking if the F-value on the SPSS output is statistically significant (p-value <0.05). Table 6.42 shows the statistical significance of the model.

Table 6-37: Significance of the technological context factors model

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47.812	6	7.969	16.173	.000
	Residual	101.008	205	.493		
	Total	148.820	211			
a. Dependent Variable: Cloud_Adoption						
b. Predictors: (Constant), Trialability, Security, Compatibility, Relative_Advantage, Complexity, Cost						

As shown in the table, F (16.173) is statistically significant at p-value =0.000, which is less than the recommended threshold of (p-value <0.05) (Hair et al. 2014). This indicates that there is a statistically significant linear relationship between technological variables and cloud adoption.

6.9.2 **Checking for MLR analysis assumptions**

The following were checked to see if there no violations on MLR analysis assumptions, sample size adequacy, multicollinearity, normality, homoscedasticity and outlier testing. These assumptions are described below.

6.9.2.1 *Sample size*

A formula **N**< 50 +8**m** is used to calculate the number of MLR analysis cases to proceed**.** **N** is the number of cases (number of respondents) while **m** is the number of technological variables. There are six (6) variables for technological factors; thus, the minimum number of cases required for conducting MLR analysis was 94. The required cases are well below the population size, which was at 212, thus satisfying the sample size assumption to proceed with MLR analysis.

6.9.2.2 *Multicollinearity*

Multicollinearity refers to the magnitude of correlation among independent variables. Multicollinearity occurs when the independent variables are highly correlated when r = 0.9 and above (Pallant, 2020). Multicollinearity can be detected by three different criteria: checking the correlation of independent variables and checking the tolerance level and the variance inflation factors (VIF).

As shown in Table 6.39, the correlation of technological factors ranges from -0.365 to 0.520, showing that there were no multicollinearity cases. The criteria for both tolerance level and VIF are displayed in Table 6.43 below.

Table 6-38: The tolerance levels and VIF values of technological factors.

Coefficients										
Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.812	.670		2.706	.007	.492	3.133		
	Relative Advantage	-.182	.119	-.115	-1.538	.126	-.416	.051	.596	1.678
	Compatibility	.225	.078	.196	2.892	.004	.072	.379	.723	1.383
	Security	.096	.067	.087	1.442	.151	-.035	.227	.915	1.093
	Complexity	.087	.106	.069	.818	.414	-.122	.295	.466	2.147
	Cost	-.126	.112	-.100	-1.119	.265	-.347	.096	.418	2.394
	Trialability	.311	.066	.374	4.715	.000	.181	.442	.525	1.905
a. Dependent Variable: Cloud_Adoption										

According to Pallant (2020), tolerance level indicates how much the variability of a specific independent variable is not explained by other independent variables, whereas VIF is the inverse of tolerance. Low to no multicollinearity presence is detected when there is a high level of tolerance and a low level of VIF. According to Hair et al. (2014), any variance inflation factor (VIF) that exceeds ten (10) and tolerance value lower than 0.10 indicates a potential problem of multicollinearity; therefore, the recommended tolerance level should be above 0.1 whereas VIF should not exceed ten (10).

The result from Table 6.43 shows that multicollinearity does not exist among all independent variables because the Tolerance values range from 0.418 to 0.915 above the 0.10 threshold and VIF values range between 1.093 to 2.394, well below the maximum threshold of 10 (Hair et al. 2014; Pallant, 2020).

6.9.2.3 *Normality Test*

The normality assumption is that each item's data distribution and all linear combination of items is normally distributed (Tabachnick and Fidell, 2007). In simple terms, a normality test is to assess if data are normally distributed before performing MLR analysis. The study reviewed histogram and P-P plots of the regression standard residual to assess the data's normality.

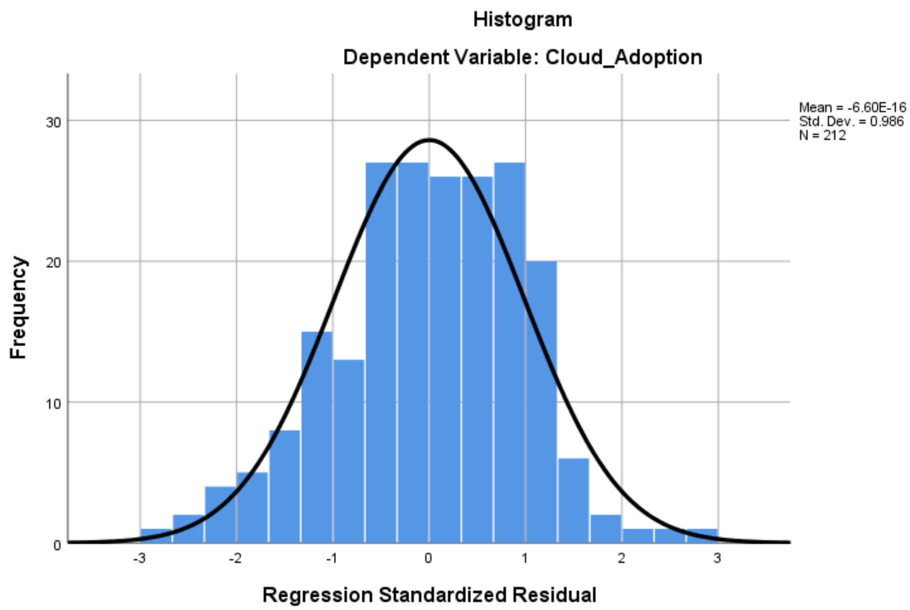

Figure 6-8*: Histogram of technological variables*

The histogram shows the normal distribution, the greatest frequency of scores is in the middle while smaller score frequencies are found both extremes of the histogram (Hair et al. 2014); thus, there was no violation of the normality assumptions on technological variables. Furthermore, this was confirmed by the P-P plot graphs below.

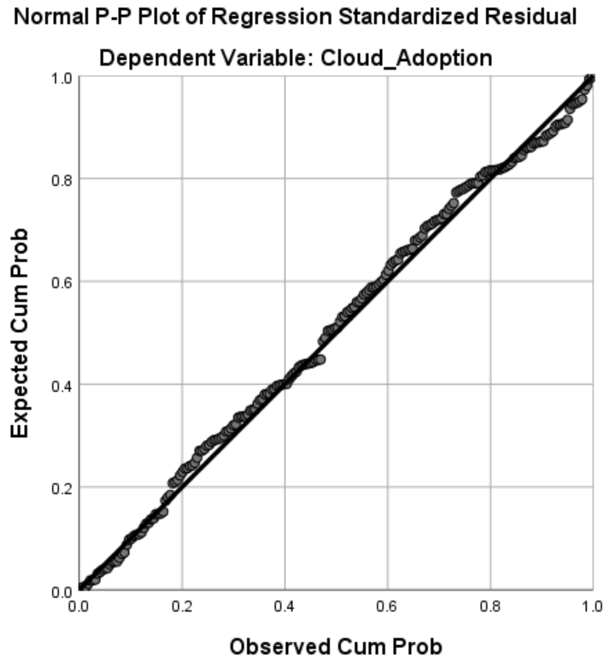

Figure 6-9: Normality P-P plot of regression standardised residuals Technological Factors.

A careful inspection of the P-P plot shows that scores are distributed on and around the diagonal line starting from the bottom left to the right. According to Field (2013), the residuals are considered normally distributed when all the data scores are near the diagonal line. Although few scores skew off the diagonal line, that does not constitute a significant violation or deviation from normality. Therefore, the normality assumption of the sample for technological factors was satisfied.

6.9.2.4 *Homoscedasticity test*

In simple terms, homoscedasticity is the extent to which the data scores for each independent variable and the dependent have equal variance (Saunders et al. 2014). In other words, homoscedasticity means the homogeneousness of the variances in both the dependent and independent variables (Pallant, 2020). A scatterplot graph is used to check the homoscedasticity assumption. Figure 6.10 shows a scatterplot of the standardised model and predicted values (Zpred V Zresid) to assess the fit of the cloud adoption model.

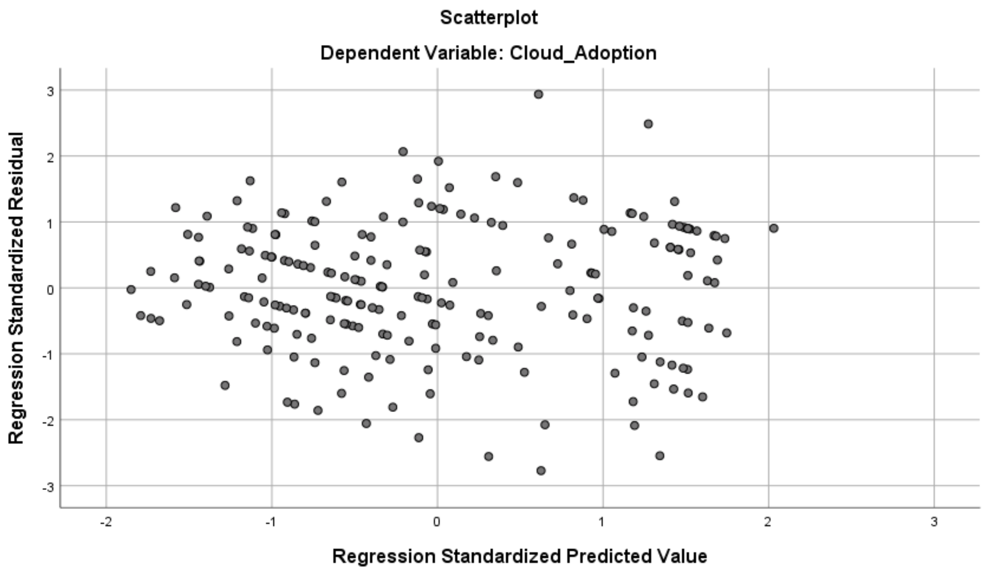

Figure 6-10: A scatterplot of the standardised model and predicted values (Zpred V Zresid)

The scores are evenly distributed along with the zero (0) line along the X and Y-axis. No patterns are apparent in the plot which indicates that the model fit is good satisfying the homoscedasticity assumptions. Thus, the homoscedasticity assumption of the sample for technological factors in this study was satisfied.

6.9.2.5 *Outlier Test*

Outliers are very high or low scores that appear in a data set (Pallant, 2020). Outliers can be checked by comparing the Mahalanobis distanced calculated on the SPSS output with the critical chi-square value (Tabachnick and Fidell, 2007). The two tables Table 6.44 critical chi-square values and Table 6.45 Mahalanobis distance are shown below.

Table 6-39: Critical chi-square values

Number of independent variables	Critical Values
2	13.82
3	16.27
4	18.47
5	20.52
6	22.46
7	24.32
8	26.13
9	27.88
10	29.59

Source: Tabachnick and Fidell, (2007)

Critical values are determined by the number of variables used to predict the dependent variable. The technological context had six variables.

Table 6-45: Mahalanobis distance SPSS output (See the highlighted Mahalanobis distance)

Residuals Statistics					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.7678	3.6154	2.6486	.47602	212
Std. Predicted Value	-1.850	2.031	.000	1.000	212
Standard Error of Predicted Value	.075	.230	.125	.027	212
Adjusted Predicted Value	1.7685	3.5444	2.6491	.47574	212
Residual	-1.94622	2.06099	.00000	.69189	212
Std. Residual	-2.773	2.936	.000	.986	212
Stud. Residual	-2.836	3.015	.000	1.003	212
Deleted Residual	-2.03689	2.17328	-.00051	.71716	212
Stud. Deleted Residual	-2.887	3.077	-.001	1.009	212
Mahal. Distance	1.428	21.641	5.972	3.148	212
Cook's Distance	.000	.071	.005	.010	212
Centered Leverage Value	.007	.103	.028	.015	212
a. Dependent Variable: Cloud_Adoption					

Source: Tabachnick and Fidell, (2007)

To test and detect the presence of outlier cases, the critical value for six independent variables (from Table 6.44) is 22.46 and compared with the maximum Mahalanobis distance in Table 6.45, which is 21.641. If the maximum Mahalanobis distance is greater than the critical value, there are cases of outliers that must be eliminated before doing MLR analysis. It can be deduced from the two tables that there are no outliers' cases since the

Mahalanobis distance is less than the critical value, thus satisfying the outlier assumption. Since all the MLR assumptions for technological factors have been satisfied, the next stage is to do MLR analysis.

6.9.3 **Model Evaluation**

As stated in SRQ4 in Chapter 1, this part of the study sought to determine the influential factors in an organisation's decision to adopt cloud computing in Zimbabwe. Consequently, the influential factors will be used to develop a cloud adoption framework to help SMEs in Zimbabwe adopt cloud computing. A multilinear regression (MLR) analysis was performed to predict the influential technological factors that affect SMEs' adoption of cloud computing in Zimbabwe. The MLR analysis was based on the combined independent variables (relative advantage, compatibility, security, complexity, cost and trialability) shown in the three tables below.

Table 6-40: Model summary for combined technological context factors

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.567[a]	.321	.301	.70194	1.843
a. Predictors: (Constant), Trialability, Security, Compatibility, Relative_Advantage, Complexity, Cost					
b. Dependent Variable: Cloud_Adoption					

Table 6-41: ANOVA table for combined independent technological context variables

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47.812	6	7.969	16.173	.000[b]
	Residual	101.008	205	.493		
	Total	148.820	211			
a. Dependent Variable: Cloud_Adoption						
b. Predictors: (Constant), Trialability, Security, Compatibility, Relative_Advantage, Complexity, Cost						

Table 6-42: Coefficient for combined independent technological context variables

Coefficients										
Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.812	.670		2.706	.007	.492	3.133		
	Relative_Advantage	-.182	.119	-.115	-1.538	.126	-.416	.051	.596	1.678
	Compatibility	.225	.078	.196	2.892	.004	.072	.379	.723	1.383
	Security	.096	.067	.087	1.442	.151	-.035	.227	.915	1.093
	Complexity	.087	.106	.069	.818	.414	-.122	.295	.466	2.147
	Cost	-.126	.112	-.100	-1.119	.265	-.347	.096	.418	2.394
	Trialability	.311	.066	.374	4.715	.000	.181	.442	.525	1.905
a. Dependent Variable: Cloud_Adoption										

The multilinear regression model, as shown in Table 6.48 was found to be statistically significant with F-value (16.173) and p-value of 0.000, less than 0.05 (p-value <0.05). The R^2 value was found to be 0.321, indicating that the technological factors explained 32.1% of the cloud computing adoption model. The combined model was statistically significant and showed a significant relationship between the two technological independents (compatibility and trialability) variables and cloud computing. The cloud adoption equation can be derived from multilinear progression as follows:

- Cloud computing adoption = 1.812 + (0.225 * compatibility) + (0.311 * trialability).
- From the equation, a unit increase incompatibility will cause an increase in cloud adoption by a factor of 0.225, likewise a unit increase in trialability in cloud computing by a factor of 0.311.
- The two technological factors, compatibility and trialability, have a positive influence in predicting cloud computing adoption by SMEs in Zimbabwe. Trialability has a much larger influence (0.374) than that of compatibility at 0.196.

6.10 THE ORGANISATIONAL CONTEXT FACTORS

Data processed must be verified to see if it is fit MLR analysis. The first step is to check the model's significance; after that, check if the data meet MLR assumptions. The following section explains how to check for the significance of the model and MLR assumptions.

6.10.1 Checking for the significance of the model

The significance of the model (Table 6.49) was evaluated by checking if the F-value (17.023) was of statistical significance (p-value < 0.05).

Table 6-43: Significance of organisational context model

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.836	4	9.209	17.023	.000b
	Residual	111.983	207	.541		
	Total	148.820	211			
a. Dependent Variable: Cloud_Adoption						
b. Predictors: (Constant), IT_Knowledge_of_Employees, Size_of_Organisation, Top_Management_Support, Technological_Readiness						

Table 6.49 shows the p-value 0.000 to be statistically significant, confirming a statistically linear relationship between the organisational factors and cloud adoption. The next step was to check for MLR analysis assumptions.

6.10.2 Checking for MLR assumptions

The assumptions checked were for sample size adequacy, multicollinearity, normality test, homoscedasticity and outliers testing. These assumptions are explained below.

6.10.2.1 *Sample size*

Sample size to execute MLR analysis is determined by the formula **N** > 50 +8**m**, where **N** is the number of cases (number of respondents) and **m** is the number of variables. The organisational context had four variables; thus, a minimum number of 82 cases were required to carry out MLR analysis. The population sample was 212, which was well above the required cases to perform MLR analysis. The sample size assumption was satisfied to perform the MLR analysis.

6.10.2.2 *Multicollinearity test*

A few tests were carried out to check cases of multicollinearity in the data. The first test was correlation analysis Table 6.40, which showed that the correlation between organisational factors (independent variables) was between -0.314 to 0.435, showing that the variables were correlated, thus satisfying the Multicollinearity assumption.

The next tests were checking for variance inflation factor (VIF) and tolerance level tests. The information about VIF and tolerance level was extrapolated from Table 6.50 below.

Table 6-44: VIF and tolerance level values

Coefficients										
Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.898	.576		3.296	.001	.763	3.032		
	Top_Management_Support	.172	.082	.141	2.101	.037	.011	.333	.811	1.233
	Size_of_Organisation	.165	.076	.137	2.163	.032	.015	.314	.901	1.110
	Technological_Readiness	.347	.058	.409	6.010	.000	.233	.461	.787	1.271
	IT_Knowledge_of_Employees	-.344	.108	-.227	-3.185	.002	-.557	-.131	.718	1.392
a. Dependent Variable: Cloud_Adoption										

The table above shows that tolerance values range from 0.718 to the highest 0.901, which are above 0.10 the minimum permitted value (Pallant, 2020); thus, the multicollinearity assumption was not violated. This was also supported by the VIF values which range from the lowest 1.110 to the highest 1.392 and are well below the cut off recommended maximum value of 10 (Hair Jr et al., 2016; Pallant, 2020), showing that the multicollinearity assumption was not violated.

6.10.2.3 *Normality test*

The normality test is used to check if all independent variables are normally distributed (Hair et al. 2014). The test was carried out by reviewing the histogram and P-P plots, as shown in Figures 6.11 and 6.12.

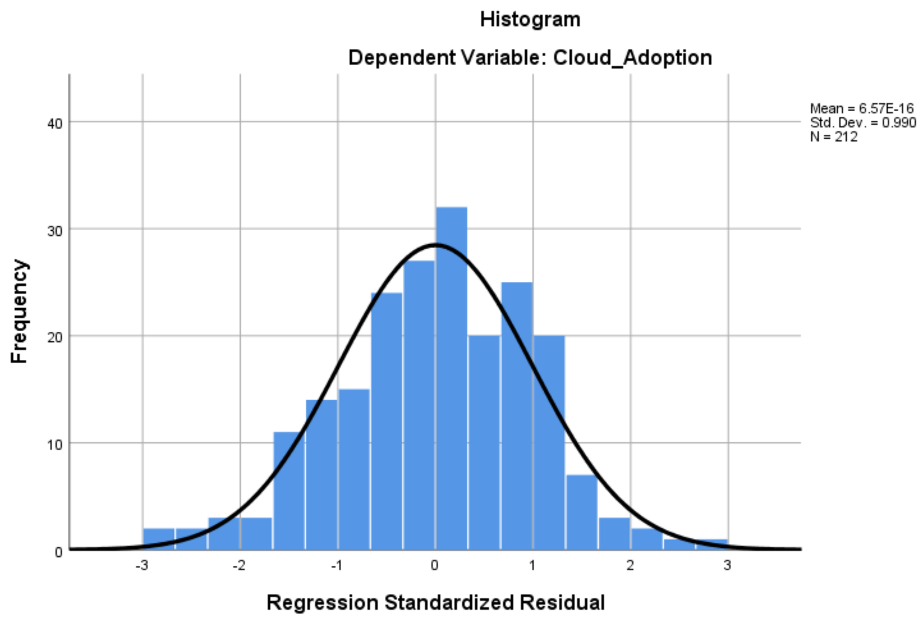

Figure 6-11: Histogram of an organisational dependent variable against independent variables

The histogram review shows a normal curve; the most significant frequency of scores in the middle and lower score frequencies are at the extremes forming a bell shape. Thus, the normality test for organisational factors was not violated.

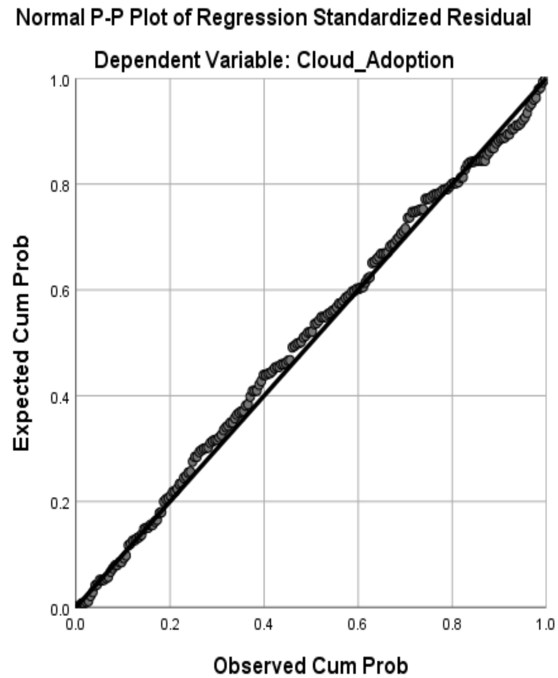

Figure 66-12: Normality P-P plot of regression standardised residuals Technological Factors

The P-P plot graph above shows that residual have a linear relationship, with scores very close to the diagonal line showing that there are no significant deviations from normality. This indicates that no multicollinearity assumption was violated.

6.10.2.4 *Homoscedasticity test*

According to Pallant (2020), homoscedasticity is the variability in the score for the X-axis variable on the scatterplot be similar to all values of variable Y. A scatterplot was used to perform a homoscedasticity check for organisational factors. Figure 6.13 below was used to conduct a homoscedasticity test.

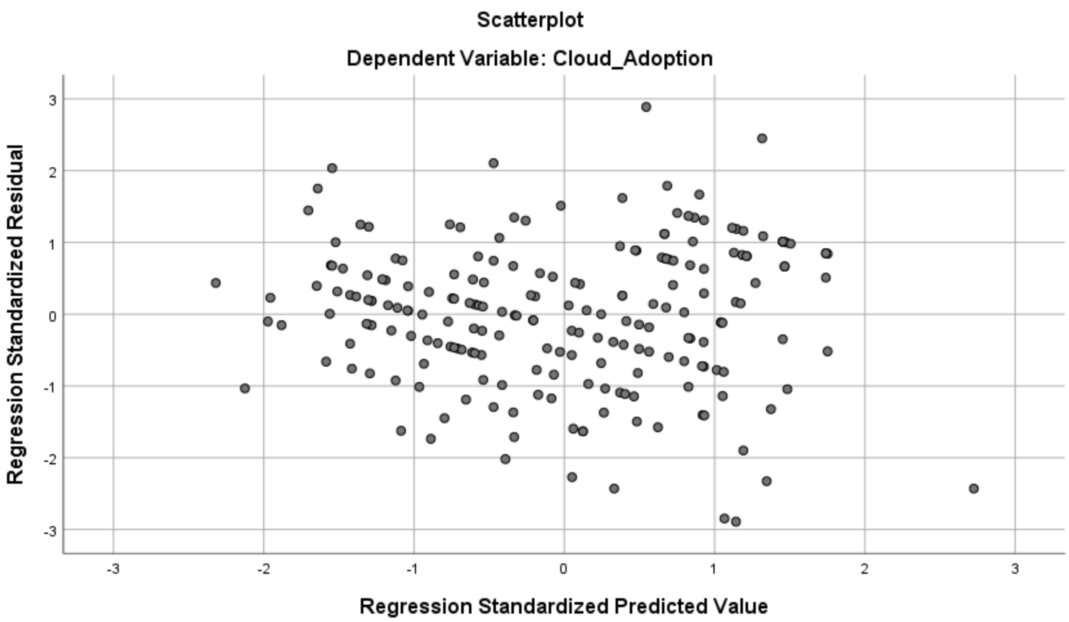

Figure 6-13: Scatterplot for homoscedasticity test for organisational factors

From the figure above, there is no indication of a funnel shape or any specific curve (Hair Jr et al., 2016), the scores are relatively evenly distributed on both the X and Y axes; thus, the data did not violate the assumption of homoscedasticity of the organisational factors.

6.10.2.5 *Outlier testing*

Outliers are extreme data points that are different from the rest of the data, and they can be very high or very low scores (Pallant, 2020). MLR is very sensitive to outliers (Hair Jr et al., 2016; Pallant, 2020); hence it is essential to detect and eliminate outliers in a data set. Outliers were checked by inspecting the Mahalanobis distance generated by the SPSS program compared to critical chi-square values (refer to Table 6.44) recommended by Tabachnick and Fidell (2007). The critical value is identified by the number of independent variables measuring a dependent variable. There were four organisational construct variables with a critical value of 18.46 (see Table 6.44).

Table 6-51: Residual statistics for organisational context factors

Residuals Statistics					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.6797	3.7871	2.6486	.41783	212
Std. Predicted Value	-2.319	2.725	.000	1.000	212
Standard Error of Predicted Value	.057	.309	.108	.032	212
Adjusted Predicted Value	1.6686	4.1710	2.6507	.42425	212
Residual	-2.12579	2.12365	.00000	.72851	212
Std. Residual	-2.890	2.887	.000	.990	212
Stud. Residual	-2.986	2.944	-.001	1.006	212
Deleted Residual	-2.26932	2.20721	-.00214	.75216	212
Stud. Deleted Residual	-3.045	3.000	-.002	1.012	212
Mahal. Distance	.275	36.322	3.981	3.673	212
Cook's Distance	.000	.308	.007	.024	212
Centered Leverage Value	.001	.172	.019	.017	212
a. Dependent Variable: Cloud_Adoption					

As shown in the table above, the maximum Mahalanobis distance calculated is 36.322, which is greater than the critical chi-square value of 18.46. If the maximum Mahalanobis distance, as is in this case, is greater than the critical value, then there are some outlier cases that must be eliminated. Outlier cases for organisational factors were detected and the identified cases were 38, 13, 17, 42 and 62. After eliminating the outliers, another model was rerun, starting the process from the beginning to check its significance and the following section details how the two processes were carried out.

6.11 THE NEW UPDATED ORGANISATIONAL MODEL

The following section details the new organisational model after eliminating the outliers detected in the older previous model.

6.11.1 Checking for the significance of the model

The table below shows the significance of the new organisational model.

Table 6-45: Checking for the significance of the model

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	39.147	4	9.787	18.783	.000[b]
	Residual	105.250	202	.521		
	Total	144.397	206			
a. Dependent Variable: Cloud_Adoption						
b. Predictors: (Constant), IT_Knowledge_of_Employees, Size_of_Organisation, Top_Management_Support, Technological_Readiness						

The F-value (18.783) is statistically significant $p < 0.05$, thus there is a statistically significant linear relationship between independent variables (organisational factors) and dependent variable (cloud computing adoption).

6.11.2 Checking for MLR assumptions

The data were checked for the following assumptions: sample size adequacy, multicollinearity, normality test, homoscedasticity and outliers testing. These assumptions are explained below.

6.11.2.1 *Sample size adequacy*

The number of required cases as determined by $\mathbf{N} > 50 + 8\mathbf{m}$ was 82. The population sample size was 207, which was above the number of required minimum cases to perform MLR analysis; thus, the sample size did not violate MLR analysis assumptions.

6.11.2.2 *Multicollinearity*

As reported in Section 6.9.2.2, three tests were carried out to check for multicollinearity. The first test conducted was to check the correlation between independent variables which was confirmed to be between -0.314 and 0.435, well below 0.9 (Pallant, 2020) as shown in Table 6.39. Thus, no cases of multicollinearity were detected.

The second and third tests conducted were on tolerance levels and VIF, respectively. Table 6.53 below is an SPSS output showing the highlighted VIF and tolerance levels.

Table 6-46: Tolerance levels and VIF values of organisational factors

Coefficients										
Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	2.487	.620		4.013	.000	1.265	3.708		
	Top_Management_Support	.125	.096	.086	1.298	.196	-.065	.314	.815	1.228
	Size_of_Organisation	.156	.076	.131	2.055	.041	.006	.305	.893	1.120
	Technological_Readiness	.338	.057	.400	5.909	.000	.226	.451	.789	1.267
	IT_Knowledge_of_Employees	-.424	.117	-.255	-3.618	.000	-.656	-.193	.724	1.382
a. Dependent Variable: Cloud_Adoption										

From the table above, the tolerance levels range from 0.724 to 0.893 well above the minimum threshold of 0.10 (Pallant, 2020) and VIF values range from 1.120 to 1.382 which are lower than the cut-off point of 10 (Hair et al., 2014; Pallant, 2020). The two tests' results show that multicollinearity assumptions were not violated, thus allowing MLR analysis to be performed on the organisational factors.

6.11.2.3 *Normality test*

A histogram and a P-P plot graph were used to test the normality of the organisational factors, as shown below.

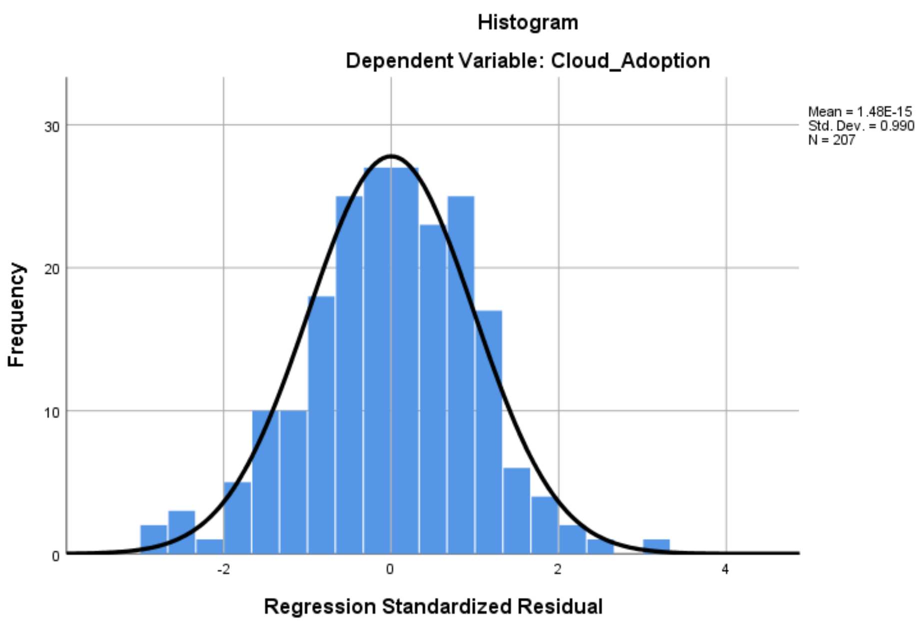

Figure 6-14: Normality test for organisational factors

The histogram has a bell-shaped showing normal data distribution, satisfying the normality assumption.

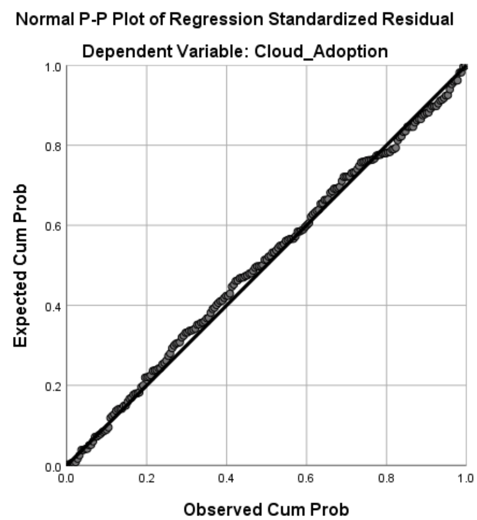

Figure 6-15: P-P plot graph of organisational factors

As shown in Figure 6.15, the scores are distributed along the diagonal line with no significant deviations from the line. The linear relationship shows that the more closely the organisational predictive variables, the stronger will be with cloud adoption. The normality assumption of the organisational factors was satisfied because there are no major violations of the normality assumptions.

6.11.2.4 *Homoscedasticity test*

The variability of the scores on the scatterplot of standardised residuals was examined, as shown below.

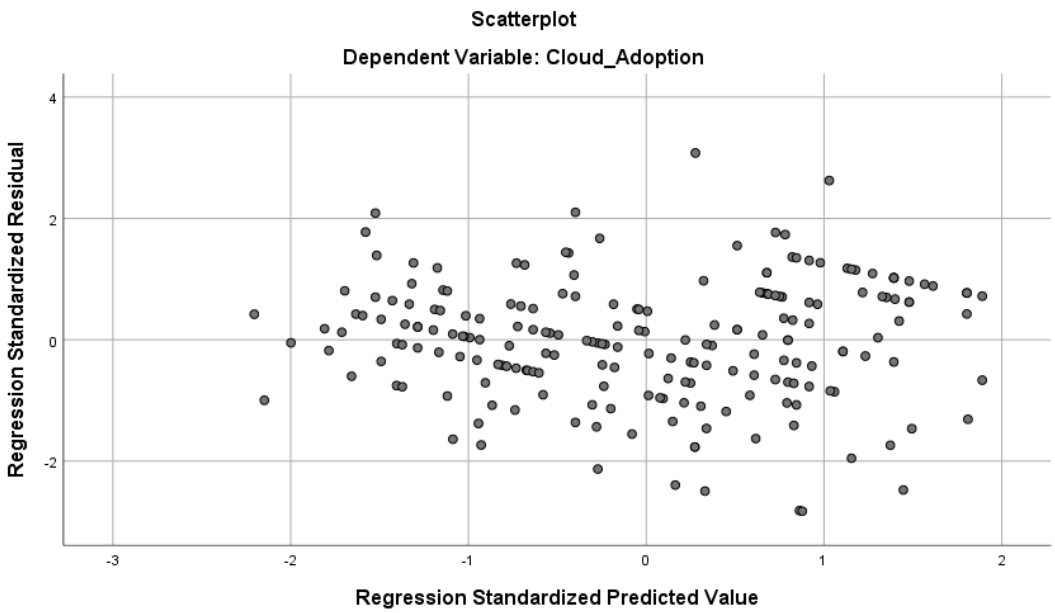

Figure 6-16: Scatterplot for organisational factors

As shown above, the residuals are concentrated along the zero (0) line on both the X and Y axes showing that no homoscedasticity violations were committed.

6.11.2.5 *Outlier testing*

The maximum Mahalanobis distance calculated from SPSS output (Table 6.54) was compared with critical chi-square values, as shown in Table 6.44. The organisational context had four variables with a critical value of 18.47 (refer to Table 6.44). The maximum Mahalanobis distance, as shown in Table 6.54 below was 16.394. The Mahalanobis distance is less than the critical values; hence no outlier cases were detected for the organisational factors. As a result, the statistical assumption validation for MLR analysis was met.

Table 6-47: Mahalanobis distance of organisational context factors

Residuals Statistics					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.6958	3.4809	2.6570	.43593	207
Std. Predicted Value	-2.205	1.890	.000	1.000	207
Standard Error of Predicted Value	.056	.210	.109	.027	207
Adjusted Predicted Value	1.6848	3.5002	2.6572	.43792	207
Residual	-2.03967	2.22257	.00000	.71479	207
Std. Residual	-2.826	3.079	.000	.990	207
Stud. Residual	-2.918	3.147	.000	1.004	207
Deleted Residual	-2.18284	2.32180	-.00024	.73497	207
Stud. Deleted Residual	-2.974	3.219	-.001	1.010	207
Mahal. Distance	.257	16.394	3.981	2.513	207
Cook's Distance	.000	.126	.006	.014	207
Centered Leverage Value	.001	.080	.019	.012	207
a. Dependent Variable: Cloud_Adoption					

After satisfying the MLR analysis assumptions, the next step was to evaluate the model.

6.11.3 **Model Evaluation**

A full model multilinear progression analysis was performed to predict influential organisational factors affecting cloud computing adoption based on combined independent variables (top management support, size of an organisation, technological readiness and IT knowledge of employees). The SPSS output of the model summary is displayed in Table 6.55 below.

Table 6-55: Model summary for combined organisational independent variables

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.521[a]	.271	.257	.72183	1.904
a. Predictors: (Constant), IT_Knowledge_of_Employees, Size_of_Organisation, Top_Management_Support, Technological_Readiness					
b. Dependent Variable: Cloud_Adoption					

As shown in Table 6.55, the multilinear regression model is statistically significant with F-value (4,202) = 18.783, p-value at 0.000 is lower than ($p < 0.05$) with R^2 (as shown in Table 6.55) at 0.271. There is a clear indication that a significant relationship exists between predictor organisational variables and cloud computing adoption. The R^2 value of 0.271 calculated suggests that the combined organisational variables explain 27.1% of the cloud computing adoption model. The three statistically significant organisational factors (size of an organisation, technological readiness, and IT knowledge of employees) influence SMEs' cloud computing adoption in Zimbabwe.

It is also essential to examine how much each of the variables contributed to the model to predict the dependent variable (cloud adoption). A multiple regression equation was formulated from Table 6.53 to evaluate the contribution of each of the three significant variables in predicting cloud adoption by SMEs in Zimbabwe. Using the unstandardised coefficients (Beta values) from Table 6.53, an equation was formulated as:

Cloud computing adoption = 2.487 + (0.156 * size of organisation) + (0.338 * technological readiness) – (0.424 * IT knowledge of employees).

In summary, it can be deduced from the equation that every unit change in the size of the organisation will affect cloud adoption by 0.125 units, and for every unit change in technological readiness will affect cloud adoption by a unit of 0.338. The negative sign on IT knowledge of employees could mean that every unit decrease of IT knowledge of employees indirectly affects cloud adoption by 0.424 units; thus, a decrease in IT knowledge of employees negatively affects cloud adoption by SMEs in Zimbabwe.

The result of multiple linear regression analysis indicates that three organisational factors, size of an organisation, technological readiness and IT knowledge of employees might influence the adoption of cloud computing by SMEs in Zimbabwe. The next section discusses the environmental factors.

6.12 ENVIRONMENT CONTEXT FACTORS

The model for environmental factors was first checked for both its significance and MLR assumptions.

6.12.1 Checking for the significance of the model for the Environmental factors

The table below shows the statistical significance of the environmental factors model.

Table 6-48: Significance of the environmental model

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	31.473	5	6.295	11.050	.000[b]
	Residual	117.346	206	.570		
	Total	148.820	211			
a. Dependent Variable: Cloud_Adoption						
b. Predictors: (Constant), Information_Intensity, Government_Regulation, Competitive_Pressure, Outsource_Cloud_Services, External_Support						

The F-value (11.050) is statistically significant, with a p-value =0.000 being less than p< 0.05. This confirms a statistically linear relationship between independent variables (environmental factors) and dependent variable (cloud adoption).

6.12.2 **Checking for MLR assumptions**

The following section will check the statistical significance of these assumptions: sample size adequacy, multicollinearity, normality, homoscedasticity and outlier cases for environmental factors.

6.12.2.1 *Sample size adequacy test*

The sample size to perform MLR analysis is determined by the formula **N** > 50 + 8**m**, where **N** is the desired number of cases and **m** is the number of variables. The environmental factors had five variables, making a minimum number of required cases to execute MLR analysis 90. The population sample was 212, which was above the required cases to perform MLR analysis. Therefore, the sample size assumption was not violated to perform MLR analysis.

6.12.2.2 *Multicollinearity test*

Three tests, correlation between independent variables, tolerance levels and VIF values were conducted to test the multicollinearity assumption. As already discussed in Table 6.40, the correlation of the environmental factors was found to range from 0.284 to 0.812 lower than the threshold of 0.9 (Pallant, 2020) confirming that there was no multicollinearity detected in the model.

Tolerance levels and VIF values were also checked to detect any cases of multicollinearity. Table 6.57shows the values of both tolerance levels and VIF.

Table 6-49: Tolerance levels and VIF values for environmental factors

Coefficients										
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	2.852	.465		6.130	.000	1.935	3.770		
	Government Regulation	.052	.059	.056	.889	.375	-.063	.168	.979	1.021
	Competitive Pressure	.372	.059	.411	6.320	.000	.256	.488	.905	1.105
	External Support	.205	.152	.147	1.348	.179	-.095	.505	.323	3.100
	Outsource_Cloud_Services	-.288	.138	-.225	-2.086	.038	-.559	-.016	.330	3.030
	Information Intensity	-.252	.102	-.165	-2.462	.015	-.453	-.050	.853	1.173
a. Dependent Variable: Cloud Adoption										

The table above shows that the tolerance values of environmental factors ranged from 0.323 to 0.979 above 0.10 (Hair et al. 2016). There were no cases of multicollinearity as confirmed by VIF values that ranged from 1.021 to 3.100 below the maximum threshold of 10 (Hair et al. 2016). Both the tolerance and VIF values show that multicollinearity assumptions in the environmental factors were not violated.

6.12.2.3 *Normality test*

The normality test can be done by inspecting the P-P plot graph, as shown below.

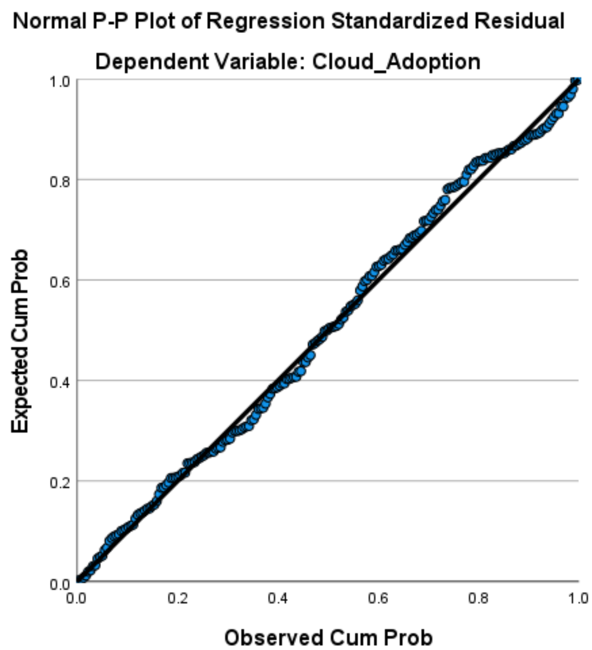

Figure 6-17: P-P plot graph showing environmental factors

The graph shows that the scores are fairly distributed along the diagonal line, showing a linear relationship between environmental factors and cloud computing adoption. The graph shows no significant violations from the normality test, thus satisfying the normality test assumptions.

6.12.2.4 *Homoscedasticity test*

A scatterplot graph is used to check the assumption of homoscedasticity. It is used to check if there is a pattern in the residual values. The scatterplot graph is shown below.

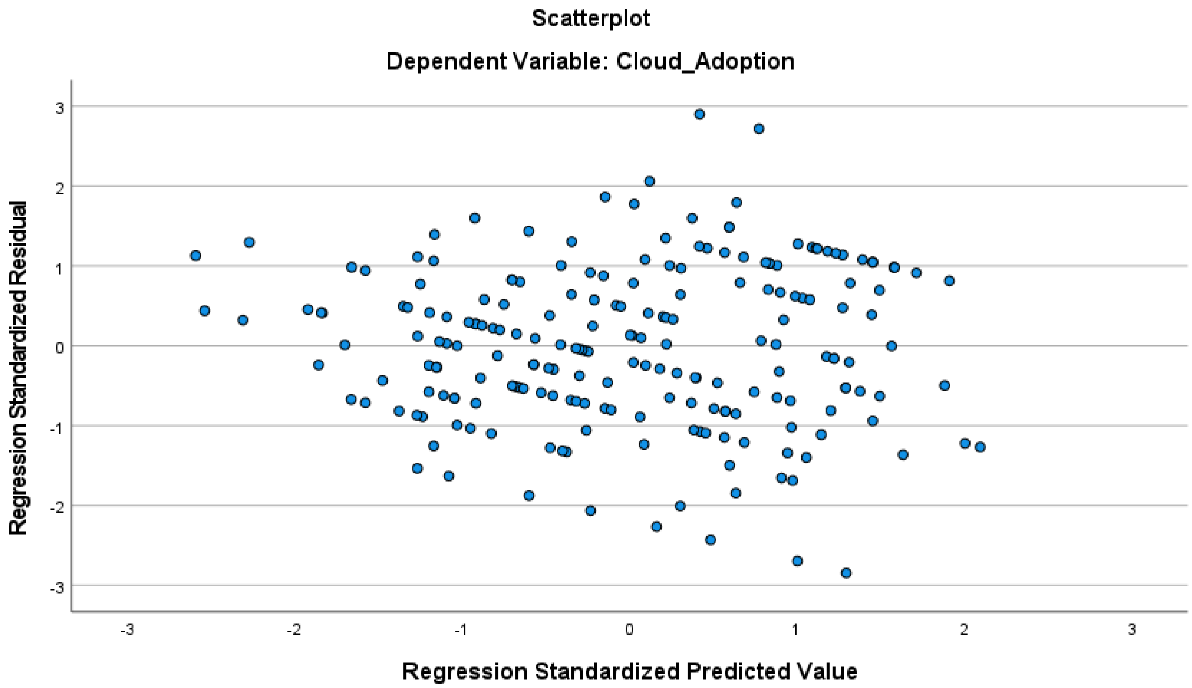

Figure 6-18: Scatterplot graph showing environmental factors

As shown in the scatterplot graph, the data points are randomly distributed along the zero (0) line on both the Y and X axes showing that the homoscedasticity assumption was met.

6.12.2.5 *Outliers Testing*

Outliers for environmental factors were checked by comparing the critical chi-square values (see Table 6.44) with the maximum Mahalanobis distance calculated from the SPSS output (Table 6.58) below.

Table 6-50: Mahalanobis distance of environmental factors

Residuals Statistics					
	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**N**
Predicted Value	1.6474	3.4575	2.6486	.38622	212
Std. Predicted Value	-2.592	2.094	.000	1.000	212
Standard Error of Predicted Value	.059	.274	.122	.034	212
Adjusted Predicted Value	1.5637	3.5015	2.6515	.39128	212
Residual	-2.14827	2.18974	.00000	.74575	212
Std. Residual	-2.846	2.901	.000	.988	212
Stud. Residual	-2.904	2.941	-.002	1.004	212
Deleted Residual	-2.23578	2.25048	-.00293	.76996	212
Stud. Deleted Residual	-2.958	2.998	-.002	1.009	212
Mahal. Distance	.292	26.805	4.976	3.577	212
Cook's Distance	.000	.080	.005	.010	212
Centered Leverage Value	.001	.127	.024	.017	212
a. Dependent Variable: Cloud_Adoption					

Environmental factors had five variables hence the critical value from Table 6.44 is 20.52 compared to 26.805 maximum Mahalanobis distance (shown in the table above). Thus, outliers cases for the environmental factors were detected because the maximum Mahalanobis distance is greater than the critical value. The outlier cases were identified and eliminated, and the process of screening data by checking MLR assumptions was restarted as detailed below.

6.13 THE NEW UPDATED ENVIRONMENTAL MODEL

The following section explains how the statistical significance and MLR assumptions of the new environmental model were checked.

6.13.1 Checking for the significance of the new model

The table below shows the statistical significance of the new environmental factors model.

Table 6-51: Significance of the new environmental factors model

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.144	5	6.629	11.817	.000[b]
	Residual	114.436	204	.561		
	Total	147.580	209			
a. Dependent Variable: Cloud_Adoption						
b. Predictors: (Constant), Information_Intensity, Government_Regulation, Competitive_Pressure, Outsource_Cloud_Services, External_Support						

The F-value (11.817) is statistically significant at p-value =0.000, which is less than the threshold of $p < 0.05$ (Hair et al. 2010). Thus, the predictive variables of environmental factors show a linear relationship with the dependent variable.

6.13.2 **Checking for MLR assumptions**

The following section highlights the MLR assumptions tested for the environmental factors model.

6.13.2.1 *Sample size test*

A formula $\mathbf{N} > 50 + 8\mathbf{m}$ was used to determine the number of cases required to execute MLR analysis. **N** is the required number of cases (number of respondents) and **m** is the number of variables in environmental factors. There were five variables in environmental factors, making 90 cases, which were below the total sample size of 210, thus satisfying the sample size assumption.

6.13.2.2 *Multicollinearity test*

The multicollinearity test was performed by checking the correlation of the independent variables from the correlation matrix reported in Table 6.41 and also checking the tolerance levels and VIF scores. The correlation between the predictive environmental independent variables ranged from 1.021 to 3.100, confirming that the independent variables are correlated, and there were no multicollinearity cases. Thus, the multicollinearity assumption for the environmental factors was satisfied.

Table 6-52: Tolerance levels and VIF values for environmental factors (new model)

Coefficients											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	3.207	.490		6.541	.000	2.240	4.173		
	Government_Regulation	.044	.058	.047	.762	.447	-.070	.159	.980	1.020
	Competitive_Pressure	.370	.058	.410	6.329	.000	.255	.485	.906	1.103
	External_Support	.148	.153	.095	.967	.335	-.154	.449	.391	2.560
	Outsource_Cloud_Services	-.343	.139	-.240	-2.468	.014	-.617	-.069	.401	2.492
	Information_Intensity	-.220	.102	-.144	-2.149	.033	-.422	-.018	.842	1.188
a. Dependent Variable: Cloud Adoption										

The table shows that the tolerance levels are all above 0.1, and the VIF scores are below the threshold of 10 (Hair et al. 2010). The tolerance levels and VIF scores show that the new model's predictive environmental factors are not excessively influencing each other, thus confirming that multicollinearity was not violated.

6.13.2.3 *Normality test*

The P-P plots and histograms were used to test the assumption of normality distribution of residuals. According to Field (2013), the residuals are normally distributed when the P-P plot points are close to the diagonal line showing a linear relationship between the environmental variables and cloud adoption.

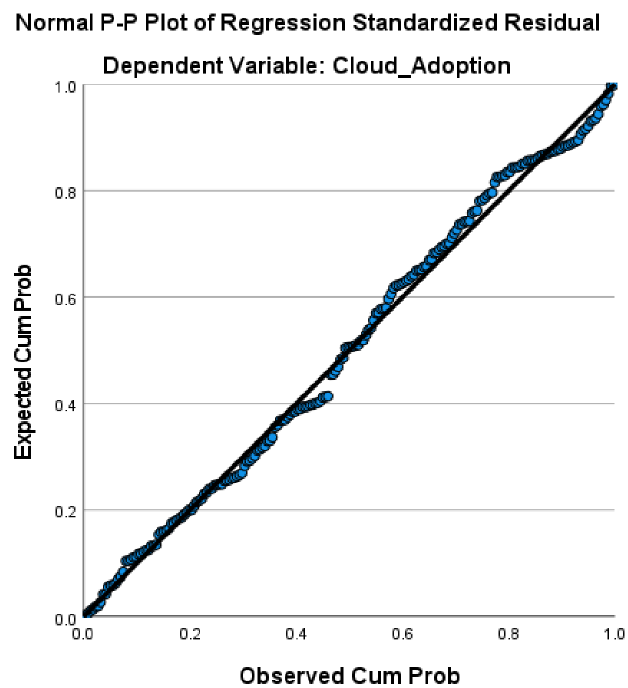

Figure 6-19: P-P plot graph showing the relationship between predictive variables and cloud adoption

Figure 6.19 shows the residuals are close to the line showing a linear relationship between environmental variables and cloud computing. The normality test was also checked using a histogram, as displayed in Figure 6.20 below.

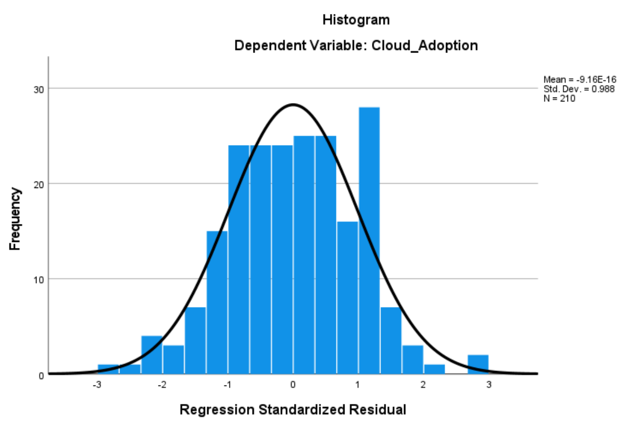

Figure 6-20: Normality test for environmental factors

The histogram shows a normal curve, it shows a symmetrical bell-shaped (Field, 2013), thus satisfying the normality assumption.

6.13.2.4 *Homoscedasticity*

The assumption of homoscedasticity was tested using a scatterplot graph.

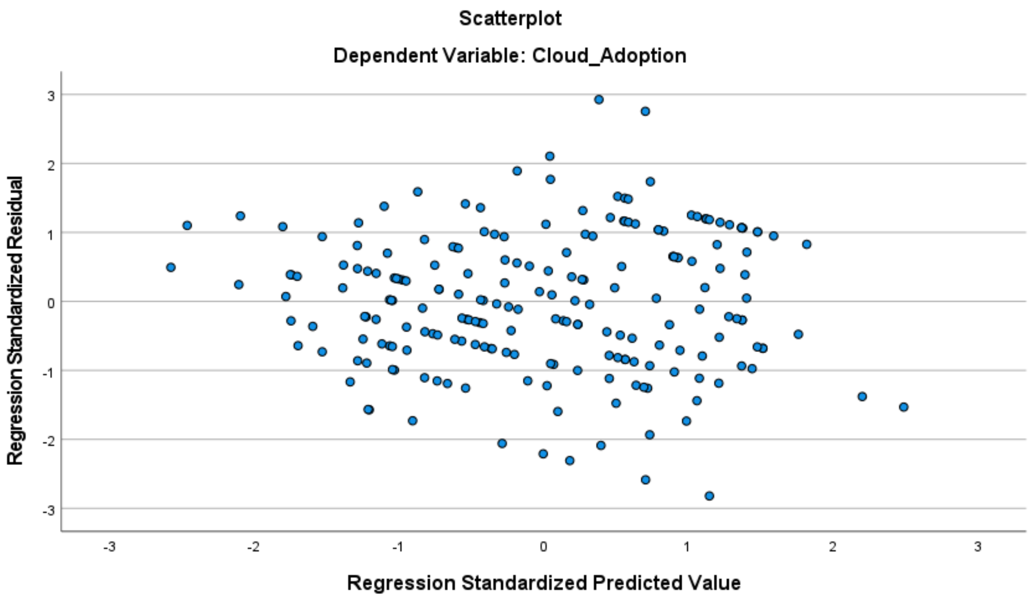

Figure 6-21: Scatterplot graph showing environmental factors

Figure 6.21 shows that data are concentrated around the zero (0) line on both the X and Y axes. The environmental factors showed a linear relationship with cloud adoption. Thus, the sample data satisfied the homoscedasticity assumption.

6.13.2.5 *Outliers test*

Outlier cases were checked by comparing the maximum Mahalanobis distance with the critical square values (see Table 6.44). The Mahalanobis distance is shown below.

Residuals Statistics					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.6298	3.6466	2.6560	.39822	210
Std. Predicted Value	-2.577	2.488	.000	1.000	210
Standard Error of Predicted Value	.059	.234	.122	.032	210
Adjusted Predicted Value	1.5935	3.7702	2.6583	.40252	210
Residual	-2.11178	2.19215	.00000	.73996	210
Std. Residual	-2.820	2.927	.000	.988	210
Stud. Residual	-2.877	2.967	-.002	1.003	210
Deleted Residual	-2.19890	2.25316	-.00230	.76338	210
Stud. Deleted Residual	-2.930	3.026	-.002	1.008	210
Mahal. Distance	.306	19.346	4.976	3.215	210
Cook's Distance	.000	.067	.005	.009	210
Centered Leverage Value	.001	.093	.024	.015	210
a. Dependent Variable: Cloud_Adoption					

Table 6-53: Mahalanobis distance SPSS output for environmental factors

From the table, the maximum Mahalanobis distance value is 19.346 compared to the critical value at 20,52 for five variables (refer to Table 6.44). The updated model does not have cases of outliers because the maximum Mahalanobis distance is less than the critical chi-square value. The absence of outliers means that the outlier test assumption was satisfied. The next step was to evaluate the model.

6.13.3 **Model evaluation**

A multilinear regression analysis was performed to predict environmental variables influencing cloud adoption by SMEs in Zimbabwe based on the combined independent variables (government regulations, competitive pressure, Information Intensity, outsource cloud services and external support). The SPSS outputs are shown in the three tables below (Tables 6.62, 6.63 and 6.64).

Table 6-54: Model summary of the combined environmental variables

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.474[a]	.225	.206	.74897	1.902
a. Predictors: (Constant), Information_Intensity, Government_Regulation, Competitive_Pressure, Outsource_Cloud_Services, External_Support					
b. Dependent Variable: Cloud_Adoption					

Table 6-55: Anova for the combined environmental independent variables

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	33.144	5	6.629	11.817	.000b
	Residual	114.436	204	.561		
	Total	147.580	209			

Table 6-56: Coefficient for the combined independent variables

Coefficients									
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	3.207	.490		6.541	.000	2.240	4.173		
Government_Regulation	.044	.058	.047	.762	.447	-.070	.159	.980	1.020
Competitive_Pressure	.370	.058	.410	6.329	.000	.255	.485	.906	1.103
External_Support	.148	.153	.095	.967	.335	-.154	.449	.391	2.560
Outsource_Cloud_Services	-.343	.139	-.240	-2.468	.014	-.617	-.069	.401	2.492
Information_Intensity	-.220	.102	-.144	-2.149	.033	-.422	-.018	.842	1.188

The R^2 (Table 6.62) of environmental factors was found to be 0.225 and explained 22.5% of the cloud adoption model. The multilinear regression model was found to be statistically significant, F (5,204) = 11.817 with p-value = 0.000. This indicates that the overall model was a reasonably good fit and statistically indicated the existence of a significant relationship between the three-predictor environmental independent factors and cloud adoption.

The multilinear regression equation was derived from Table 6.64 as:

Cloud adoption = 3.207 + (0.370 * competitive pressure) – (220* Information intensity) - (0.343 * outsource cloud-services).

The equation shows that a unit increase in competitive pressure will increase cloud adoption by a factor of 0.370 units. Also, a unit decrease in outsourcing cloud services may indirectly affect cloud adoption by a factor margin of -0.343 units. In the same way, a unit decrease in information intensity indirectly affects cloud computing adoption by a factor of -220 units.

In summary, the three environmental factors**, competitive pressure, outsource cloud services and information intensity** were found to be important in predicting cloud adoption by SMEs in Zimbabwe. Of the three factors, competitive pressure has more influence on cloud adoption.

6.14 SUMMARY OF MLR ANALYSIS OF TECHNOLOGICAL, ORGANISATIONAL AND ENVIRONMENTAL FACTORS

To summarise, the MLR analysis yielded three different equations each for technological, organisational and environmental factors. These three equations significantly predicted cloud adoption by SMEs in Zimbabwe. The three cloud computing adoption equations are as follows:

Technological factors equation (Section 6.9)

Cloud computing adoption = 1.812 + (0.225 * compatibility) + (0.311 * trialability).

Organisational factors equation (Section 6.10)

Cloud computing adoption = 2.487 + (0.156 * size of organisation) + (0.338 * technological readiness) – (0.424 * IT knowledge of employees).

Environmental factors equation (Section 6.12)

Cloud adoption = 3.207 + (0.370 * competitive pressure) - (220* Information intensity) - (0.343 * outsource cloud-services).).

The three equations were combined to form one overall cloud adoption equation for SMEs in Zimbabwe. Thus, the overall equation is presented as follows:

Cloud computing adoption = Technological factors + organisational factors + organisational factors.

Cloud computing adoption = 1.812 + (0.225 * compatibility) + (0.311 * trialability) +2.487 + (0.156 * size of organisation) + (0.338 * technological readiness) – (0.424 * IT knowledge of employees) + 3.152 + (0.370 * competitive pressure) – (220* Information intensity)) - (0.343 * outsource cloud-services).

The revised cloud computing model, the Zimbabwe Cloud Adoption Model (ZiCAM) presented below was derived from the three combined equations, and it shows that eight independent variables (compatibility, trialability, size of an organisation, technological readiness, IT knowledge of employees, competitive pressure, information intensity and outsource cloud-services) significantly predicted cloud adoption by SMEs in Zimbabwe.

6.14.1 **The revised cloud adoption model (The ZiCAM)**

Based on the MLR analysis, influential factors affecting an organisation's decision to adopt cloud computing were identified. The main aim of the study is to develop a cloud adoption framework that will be used by SMEs in Zimbabwe to adopt cloud computing. To answer the research question, the results from MLR analysis were used to develop the following revised model, the Zimbabwe Cloud Adoption Model (ZiCAM) in Figure 6.22 (see Chapter 4 for the preliminary framework and Chapter 5 for the intermediate framework). MLR analysis was used to determine an association between a single dependent variable (cloud adoption) and several independent variables from technological, organisational and environmental factors. Multilinear regression analysis was appropriate for this part of the study to predict and identify the most influential factors in an organisation's decision to adopt cloud computing technology in Zimbabwe. Three multilinear regression analyses were conducted. The first was to analyse the relationship between cloud computing and technological factors (relative advantage, compatibility, security, complexity, cost and trialability). Secondly, cloud adoption (dependent variable) was analysed against organisational factors (top management support, size of an organisation, technological readiness and IT knowledge of employees). Lastly, cloud adoption was analysed against environmental factors (government regulations, competitive pressure, outsource cloud services, information intensity and external support). The findings from MLR analysis as already mentioned above yielded eight variables (compatibility, trialability, size of an organisation, technological readiness, IT knowledge of employees, competitive pressure, outsource cloud-services and information intensity) that significantly predicted cloud adoption in Zimbabwe and consequently explained the significance of the cloud computing adoption model, the Zimbabwe Cloud Adoption Model in the Zimbabwean SMEs adopting cloud computing.

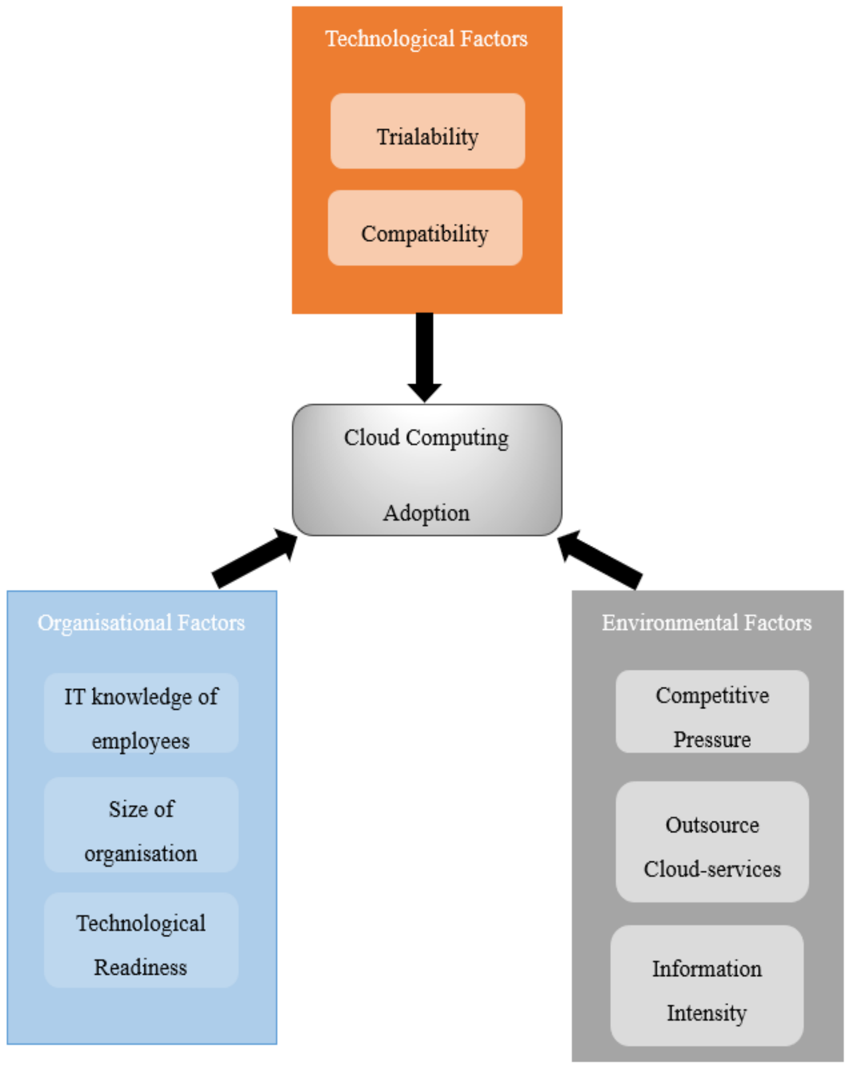

Figure 6-22: Revised Final Cloud Computing Adoption Framework (ZiCAM) (Source: author)

6.14.2 **Evaluation of artefact**

As discussed in Chapter 2, this research used MLR analysis to evaluate the fitness of the artefact (ZiCAM). MLR is an analytical tool that examines the statistical significances and coefficients' magnitude (Khayer et al., 2020). As a statistical tool, MLR was used to predict with power the independent variables affecting cloud adoption by SMEs in Zimbabwe.

MLR analysis uses assumptions to examine and evaluate the fitness of variables to the model. The following assumptions were tested to evaluate the goodness of fit of the model's variables, sample size, multicollinearity, normality test, homoscedasticity and testing for outliers (see Sections 6.9.2, 6.10.2, 6.11.2, 6.12.2 and 6.13.2). However, before checking for assumptions, the significance of the model (the F-value) must be checked first for statistical significance.

6.15 OPEN-ENDED QUESTIONS

The questionnaire survey included four open-ended questions that asked SMEs to freely express their opinion about any other useful additional information about factors and barriers affecting their individual SMEs to adopt cloud computing. Consequently, 250 responses were received; however, a total of 38 questionnaires were invalid. Thus, a total of 212 (61%) answered and completed the open-ended questions. Each question represented a theme, and these themes were identified as top drivers to cloud adoption, reasons for adopting cloud computing, issues SMEs worry about when they decide to adopt cloud computing and lastly any important suggestions to accelerate the adoption of cloud computing. These themes are presented below as drivers to cloud adoption (theme 2 was subsumed in theme 1), issues, concerns, and suggestions.

6.15.1 Drivers to cloud adoption in SMEs in Zimbabwe

This section presents the findings from the open-ended questions on some factors that drive SMEs to adopt cloud computing. The findings are important to decision-makers, service providers and the government to incentivise SMEs to adopt cloud computing. The main themes derived from the answers to the open-ended questions are summarised below and regarded as the main drivers.

6.15.1.1 *To reach new global markets.*

One of the most mentioned drivers to cloud adoption was the need to reach new markets. Due to globalisation, the competition for markets has become so stiff that only the fittest organisations (in terms of proper technology use) can survive. SMEs need to adapt to the new world order of doing things to survive. Cloud computing adoption is both a strategic tool and a technology that can help SMEs survive by reaching the global markets. As mentioned in Section 6.36, about 91.5% of SMEs in Zimbabwe cater to local markets.

Many respondents observed that cloud adoption helps expand their businesses and penetrate new global markets. By penetrating new markets, some respondents want to reach many new customers quickly and easily.

6.15.1.2 *To reduce costs*

Responses show that most SMEs would adopt cloud computing to reduce operational costs. By their small nature in terms of both organisational size and budget allocation to IT infrastructure, cloud computing adoption becomes an advantage because there will be no need to buy expensive IT infrastructure. As noted by most respondents, adopting cloud computing eliminates costs involving systems upgrades, data storage and software licencing. Some respondents observed that cloud computing adoption “reduces the cost of buying new computer equipment and consumables.” The other respondent agreed that cloud computing adoption “comes with everything, software and antiviruses; hence there is no need to buy these.”

6.15.1.3 *To be competitive in the global market.*

Adopting cloud computing abrogates the IT and other technical issues to the service provider leaving the SMEs to focus and concentrate on their core business. As observed by many respondents, when SMEs focus on core business, they become more efficient and produce quality goods and services that are competitive on the global market.

6.15.2 **Issues and concerns of cloud computing adoption**

The following issues as depicted in Table 6.65 was raised by the SMEs:

Table 6-57: Issues and concerns raised by SMEs

Issues	Concerns
Security of data	SMEs are concerned about their data security on the cloud platform, safeguarding data from breaches threats like system vulnerabilities, virus attacks and hacking of their data. Increasing awareness might help SMEs to appreciate the safety of data stored on the cloud.
Privacy of Data	Tied to the security issue is the privacy of their data, are data safe from being accessed by saboteurs and competitors? SMEs are also concerned about legal issues about their data being kept in a different country, what legal recourse will arise if there is a breach of the data?
Lack of IT infrastructure	Most SMEs lament the general malaise in IT infrastructure, poor internet connectivity and lack of local cloud service providers in Zimbabwe.
Lack of electricity	SMEs experience intermittent electricity supply, and electricity availability for only a few hours per day would not favour cloud computing adoption.
High data costs	Most SMEs lament the high cost of data. Service providers charge exorbitantly, and most SMEs cannot afford to buy data for Internet access. The price of data in Zimbabwe is one of the highest in the world.
Lack of service providers	There are few cloud service providers, and these providers must improve the quality and reliability of their services to enhance cloud computing adoption. Opening up space to more cloud service providers might induce competition among the providers, thereby lowering the cost of data.
Lack of Skills to use cloud computing	There is a lack of skills from both decision-makers and employees to use cloud computing.
Lack of government policies	Several respondents concurred that there was neither a clear government policy on cloud adoption nor incentives to encourage SMEs to adopt cloud computing.
Compatibility issues	Most SMEs are still using their legacy systems and very much worried about compatibility issues of cloud computing adoption and their current ways of doing business.
No incentives from government and service providers	Government and service providers must market their products to make SMEs aware of the benefits of cloud computing. They must also train SMEs on how to use cloud computing.

6.15.3 **Suggestions from SMEs**

The respondents have put forward several suggestions. A summary of the suggestions is as follows:

- To increase the cloud computing adoption rate, the government should craft a cloud computing policy and incentivise SMEs to adopt cloud computing.
- The government should improve the digital infrastructure and encourage its citizens to use digital technology.

- Some respondents encouraged the government to set the digital transformation pace by digitising its systems to encourage the citizenry to follow suit.
- Other respondents suggested that the government invite and issue more licences in the telecom industry to increase competition, thus lowering the cost of data.
- Many respondents would want service providers to play a significant role in marketing their products and train SMEs to use cloud computing in their businesses.
- Other respondents intimated on the need for cloud computing service providers to customise their services to cater to a large base of SMEs.

Therefore, it is crucial for the government and cloud service providers to allay the concerns and consider the given suggestions to accelerate cloud adoption by SMEs in Zimbabwe.

6.16 SUMMARY

This chapter was phase two of part two involving the phaseon the quantitative part of this study. The chapter explored and identified factors influencing organisations to adopt cloud computing. Multilinear regression was performed on the data to provide quantitative evidence of the influential factors affecting SMEs in Zimbabwe to adopt cloud computing.

As shown in the revised model, the identified influential factors affecting an organisation's decision to adopt cloud computing were trialability and compatibility (technological factors), size of an organisation, IT knowledge of employees and technological readiness (organisational factors) and lastly competitive pressure, outsource cloud-services and information intensity (environmental factors). There were eight most influential factors identified in the revised final cloud adoption model compared to fifteen in the intermediate model in Chapter 5 (the qualitative study). Finally, the chapter ended with a discussion of the last four open-ended questions on the survey questionnaires in which respondents were free to articulate their concerns in adopting cloud computing and proffer suggestions to the stakeholders on how they can help SMEs accelerate cloud adoption.

CHAPTER 7 DISCUSSION OF QUANTITATIVE RESULTS

7.1 INTRODUCTION

The previous chapter presented a quantitative analysis of the data collected from an online survey questionnaire sent to decision-makers in sampled SMEs in both Harare and Bulawayo cities. MLR analysis was used to identify the most influential factors affecting cloud computing adoption by SMEs in Zimbabwe. A new cloud adoption model, the Zimbabwe Cloud Adoption Model (ZiCAM), was presented. This chapter presents an extensive discussion of the results from the previous chapter. After correlation analysis, fifteen variables were found to correlate with cloud adoption by SMEs in Zimbabwe. However, after the MLR analysis, only eight variables seemed to influence SMEs' cloud adoption in Zimbabwe. The eight influential cloud adoption factors were identified and classified as either technological, organisational or environmental factors.

7.2 TECHNOLOGICAL FACTORS

Technological factors include the internal and external technology available and useful to an organisation to conduct its business (Harfoushi et al., 2016). Internal technology refers to the IT infrastructure currently in use within the organisation, while external technology is the technology in the marketplace that can be used by an organisation (Al-Hujran et al., 2018; Harfoushi et al., 2016).

The following factors were classified as technological factors, relative advantage, complexity, compatibility, security, trialability and cost. These factors were gleaned from the DOI framework (Moh'd Anwer, 2019). The findings indicated that all six technological factors correlated with influencing cloud adoption by SMEs in Zimbabwe. After performing MLR analysis on the six factors, unexpectedly, only two factors, compatibility and trialability, were indicated as the most influential technological factors that affects Zimbabwean SMEs to adopt cloud computing. All the other factors were found to be insignificant. This could be because cloud computing adoption is still in its early stages in Zimbabwe and that the SMEs could be less concerned about these factors or most probably lack awareness of the significance of these factors. The results were surprising in that they are inconsistent with findings from prior studies that found relative advantage, security, complexity and cost to influence cloud computing adoption by SMEs (Ayong & Naidoo, 2019; Chathurika, 2019; Gide & Sandu, 2015; Prause, 2019; Skafi et al., 2020). Zimbabwe is a developing country, and most people may be lacking knowledge about the advantages of adopting the advanced technologies like cloud computing. Some of the reasons why relative advantage, security, complexity and cost have been found to be insignificant in cloud adoption by SMEs in Zimbabwe are discussed in Section 3.6. The following section discusses the two technological factors that influence cloud computing adoption by SMEs in Zimbabwe (compatibility and trialability).

7.2.1 **Compatibility**

Compatibility as a technological factor was found to be an influential factor in cloud adoption by SMEs (Selase et al., 2019; Skafi et al., 2020). Harfoushi et al. (2016) define compatibility as the degree an innovation is seen as consistent with existing values, previous experiences and current needs of the customers. Research has shown that the greater the technology fit to the current way of doing business, the more the likelihood of acceptance of the technology (Selase et al., 2019; Skafi et al., 2020). For cloud computing to be accepted, it must be easy to integrate with the existing system.

The findings show that there was a significant relationship between compatibility and cloud computing by SMEs in Zimbabwe. The study results are consistent with prior studies on the influence of compatibility in cloud adoption by SMEs. Yeboah-Boateng and Essandoh (2014) found compatibility an essential factor in influencing cloud adoption by SMEs in developing countries. Sallehudin et al. (2015) found that compatibility was an essential attribute in adopting new technology in a study to explore security determinants in big data solution adoption. Senyo and Effah (2016) determined that compatibility was an important factor in cloud adoption in developing countries. Other recent studies by Moh'd Anwer (2019), Oliveira et al. (2014) and Skafi et al. (2020) also confirm that compatibility is an essential factor in the adoption of new technology like cloud computing by SMEs.

Ahmed, Ammar, and Ali (2016) observe that cloud computing adoption will be a challenge if a country's existing infrastructure does not comply with cloud computing. The results show that SMEs in Zimbabwe should pay more attention to compatibility issues to increase the cloud adoption rate. Thus, the SMEs must put in place IT infrastructure and IT policies that are compatible with cloud computing adoption. Cloud service providers should also customise their services to be compatible with SMEs from different sectors to increase adoption by many SMEs from different sectors.

7.2.2 **Trialability**

Skafi et al. (2020) and Abdul Hameed and Arachchilage (2017) define trialability as the degree to which consumers experiment with innovation on a limited basis. This study's findings showed that trialability was a significant driver in cloud adoption by SMEs in Zimbabwe. SMEs that have a chance to experiment with cloud computing during a pre-adoption period are likely to have a higher tendency to adopt (Senarathna et al., 2018). Testing cloud computing before its adoption is important because it gives SMEs a more incredible opportunity to evaluate it and see how best it can be utilised within an organisation (Widyastuti & Irwansyah, 2018).

A possible explanation of why trialability was found to be significant could be that trialability helps to reduce the perceived risks of investing organisation resources into an unsuitable new technology (Senarathna et al., 2018). At the same time, trialability increases awareness (Skafi et al., 2020) which could accelerate cloud adoption by SMEs in Zimbabwe. Abdul Hameed and Arachchilage (2017) and Senarathna et al. (2018) advise that trialability is usually significant in the early stages of introducing a new technology in which trial versions will be offered to the SMEs. This is important to SMEs in Zimbabwe because it builds intimacy, improving acceptance (Widyastuti & Irwansyah, 2018).

This study's findings corroborate previous studies that confirmed that trialability was an essential factor in cloud adoption. A study by Ahn and Ahn (2020) found that trialability has a significant influence on the adoption of cloud-based ERP in Korea. Johnson et al. (2020) confirm that trialability influences the adoption of mobile self-checkout systems in small businesses in the United States. A study by Odumeru (2013) found trialability to be a significant predictor in Nigeria's mobile banking adoption.

These findings are essential to both SMEs and cloud service providers. The SMEs need to run cloud computing on their premises for a limited time to study how cloud computing operates. Simultaneously, cloud service providers should provide an adequate trial period to build trust and acceptance in SMEs.

However, the findings of this study are inconsistent with several previous studies that show that trialability has an insignificant influence on the adoption of an innovation such as cloud computing (Chathurika, 2019; Nasser & Jawad, 2019; Prause, 2019; Skafi et al., 2020).

7.3 ORGANISATIONAL FACTORS

This study defines the organisational factors as different features within an organisation, such as scope, size, IT infrastructure, IT knowledge and managerial structure, which should help speed up cloud computing adoption (Ilin et al., 2017). This research showed that IT knowledge of employees and technical readiness were the most influential organisational factors that affect cloud adoption by SMEs in Zimbabwe. The three influential factors are discussed below.

7.3.1 **Size of organisation**

There is no homogeneity on the definition of the size of the organisation. Some studies define an organisation's size in terms of the number of employees, annual turnover, size of investment and others in terms of market scope (Ali et al., 2018; Khalifa, 2016). This study defines the size of an organisation by how many employees work in the organisation.

The findings of this research showed that the size of an organisation is statistically significant in influencing SMEs in Zimbabwe to adopt cloud computing. As observed in Figure 6.3, the number of employees in the sampled SMEs ranges from between two to five employees. This shows that; indeed, the SMEs are very small enterprises in Zimbabwe. The findings confirm that even though they are small enterprises, the SMEs are willing to adopt cloud computing, possibly because they are more agile and flexible in terms of their organogram structure, and hence decisions to adopt can be made faster as compared to big organisations (Ayong & Naidoo, 2019). Generally, SMEs, especially those in developing countries like Zimbabwe, are poorly resourced. Cloud computing is touted as a panacea to solving their problems of the lack of resources and can support them to be at the same competitive level as large businesses. The emergence of affordable technology has helped remove the dividing line between SMEs and big organisations in terms of IT infrastructure and competitiveness in the global market.

This research's findings are consistent with findings from prior studies that confirm that an organisation's size influences cloud adoption in SMEs. A study by Palos-Sanchez (2017) to empirically analyse factors that determine cloud computing adoption in Spain found that firm size directly affects cloud adoption. Oliveira et al. (2014) identify firm size as an essential factor in adopting cloud computing by SMEs in Portugal. In another study, Ahn and Ahn (2020) conclude that firm size is one of the critical determinants of factors affecting the successful adoption of cloud adoption in South Korea.

However, some studies argue that SMEs have a lower propensity to adopt cloud computing than bigger organisations (OECD/ERIA, 2018) because they lack the skills base and experience to adopt new technology (Senarathna et al., 2018). Furthermore, large firms have professional IT departments and research and development departments that always follow IT market trends and continuously upgrade their IT infrastructure to keep abreast with new trends (Haug, Kretschmer, & Strobel, 2016). However, Rahayu and Day (2015) argue that the advent of cloud computing has diminished the resource gap between SMEs and large organisations. Hence the adoption of cloud computing helps SMEs to be globally competitive at the same level as the hugely resource endowed large organisations.

7.3.2 **IT knowledge of employees**

IT knowledge of employees has been identified as one of the most influential factors in adopting cloud computing in developing countries like Zimbabwe (Adane et al., 2019). This study defines IT knowledge of employees as the availability of skills base with an organisation to competitively and effectively utilise and support the adoption of innovation like cloud computing.

The research findings seemed to confirm that IT knowledge of employees influences the adoption of cloud computing by SMEs in Zimbabwe. The findings show that a unit decrease in lack of IT knowledge by employees causes a decrease of cloud adoption by 0.424 units. Lack of IT knowledge and understanding of e-commerce leads to low adoption of advanced technology by SMEs in developing countries like Zimbabwe (Rahayu & Day, 2015). Table 6.9 shows that about 95.3% of SMEs in Zimbabwe still use simple technology for operational instead of strategic purposes. Research shows that the utilisation of simple basic technology is attributed to low skills in SMEs (Prasanna et al., 2019).

Similarly, Makiwa and Steyn (2018) indicates that the lack IT skills and IT knowledge hamper the adoption and use in Zimbabwean SMEs. Furthermore, the study laments that most employees in Zimbabwe do not have formal ICT training (Makiwa & Steyn, 2018). The findings of this research showed that IT knowledge of employees influences cloud adoption. Thus, SMEs must develop and skill their employees to accelerate cloud adoption by SMEs in Zimbabwe. Sadly, Makiwa and Steyn (2018) bemoan that most SME owners in developing countries like Zimbabwe do not value ICT training as a critical component of employee development which in the long run could benefit the organisation. This skewed reasoning could be due to a lack of awareness of the benefits that will accrue to SMEs by adopting an innovation like cloud adoption. In most cases, the SMEs are concerned about day-to-day survival instead of growth strategies (Ullah et al., 2019) and view training as a waste of meagre company resources.

This study's findings corroborate with previous studies that confirm that IT knowledge of employees positively affects the adoption of cloud computing. A study by Mustafa and Yaakub (2018) shows that a lack of knowledge in advanced technology by employers and employees causes fear among SMEs in Malaysia to utilise advanced technology. A study on IT adoption and growth of SMEs in Uganda by Ibrahim, Turyakira, and Katumba (2019) reveals that lack of awareness of IT's importance in business and lack of IT knowledge and expertise by owners and employees negatively affect cloud computing adoption by SMEs in Uganda. Gangwar et al. (2015) advise that training of employees helps them understand the functional and technical aspects of cloud computing and thus improves the perceived ease of use and consequently improves the rate of cloud adoption. Chathurika (2019) concurs that trained employees find it easy to perform their duties effectively utilising cloud computing services. Therefore, the Zimbabwean government must initiate ICT training for SME owners and their employees to improve cloud computing adoption. The government should include an ICT curriculum in schools and not just at the university level as some SMEs owners may not reach the university level. Service providers must also provide training programmes to skill the SME to increase cloud computing adoption in Zimbabwe.

7.3.3 Readiness of organisation

Research indicates that technological readiness is a crucial factor influencing cloud adoption in SMEs (Alkhalil et al., 2017; Kandil et al., 2018). Technological readiness is a broad concept that spans from skilled human resources, IT infrastructure, and society's connectivity at large (Kandil et al., 2018). Similarly, Okundaye, Fan, and Dwyer (2019) observe that technological readiness is affected by several factors which include the cost of implementing new technology, availability of ICT skills, poor ICT infrastructure and lack of government support for SMEs. This study defines technological readiness as the readiness of IT infrastructure, IT policy availability, and skilled human resources within SMEs to influence cloud computing adoption (Harfoushi et al., 2016).

This research showed that an organisation's technological readiness influences cloud computing adoption by SMEs in Zimbabwe. Insights in the research findings showed that most SMEs (95.3%) are still using basic non-interactive cloud-based applications (see Table 6.9). Research shows that the low-level utilisation of advanced technologies indicates low technological readiness by SMEs in developing countries (Prasanna et al., 2019). According to Gangwar et al. (2015), SMEs with a higher IT readiness level are likely to adopt cloud computing.

Unsurprisingly, the study's findings are consistent with prior studies that confirm the significance of technological readiness in cloud adoption by SMEs. Moh'd Anwer (2019)identified technological readiness as an influential factor in adopting cloud-based ERP by SMEs in developing countries. A study by Abdul Hameed and Arachchilage (2017) to investigate cloud computing adoption by SMEs in Ghana reveals that technological readiness influences cloud adoption by SMEs in Ghana. (Gutierrez et al., 2015) explored factors influencing managers' decision to adopt cloud computing found technological readiness to be one of the critical factors impacting cloud adoption in developing countries. Oliveira et al. (2014) found that technological readiness directly affects cloud adoption by SMEs in Portugal.

The study results should inform SMEs and the government to help develop IT infrastructure to help accelerate the adoption of cloud computing in Zimbabwe. The current level of technological readiness of SMEs in Zimbabwe is a microcosm of the broader society's technological readiness. Zimbabwe is ranked lowly in terms of the network readiness index. The network readiness assesses ICT impacts on society and nations' development (NRI, 2019). In terms of index global index, Zimbabwe is ranked 119 out of 121 countries (NRI, 2019).

Similarly, the network readiness pillars are also lowly ranked, and network access is ranked at 115 out of 121 countries, use of advanced technologies at 114 out of 121 countries, households with internet access is ranked at 101 out of 121, e-participation of individuals in the society is ranked at 113 out of 121, and the mobile (internet) tariffs are ranked at 115 out of 121 (NRI, 2019). The report further shows that company investments in emerging technologies are lowly indexed at 115 out of 121 countries. Thus, based on the above network index report, there is low technological readiness in SMEs and the Zimbabwean society. This research's findings point to the importance of technological readiness; thus, this should prod the government and other stakeholders to put in place the necessary IT infrastructure to accelerate the adoption of cloud computing by SMEs.

7.4 ENVIRONMENTAL FACTORS

Environmental factors refer to the environment where the organisation conducts its business (Harfoushi et al., 2016). This study's environmental factors include government regulations, competitive pressure, information intensity, outsource cloud services and external support.

This study's findings are surprising because only three environmental factors; competitive pressure, outsource cloud services and information intensity were found to influence cloud adoption by SMEs in Zimbabwe. Some studies reported that government regulations, competitive pressure and external support influence the adoption of technologies by SMEs (Chiu & Liu, 2008; Skafi et al., 2020; Taylor, 2019; Ullah et al., 2019; Widyastuti & Irwansyah, 2018).

A possible explanation why some factors were found to be insignificant could be the nature of the sample used in this study, the respondents came from different sectors and possibly are affected by these factors in different ways, that is, they value the cloud adoption factors differently. Besides, developing countries like Zimbabwe experience an uncertain turbulent environment in which the decision to adopt cloud computing could be affected by other factors like the politics of the country, not mentioned in the study. Furthermore, it could be related to a lack of awareness on the benefits of adopting cloud computing or possibly the lowly developed IT infrastructure among the sampled SMEs.

The three influential environmental factors, competitive pressure, outsource cloud services and information intensity are further discussed below.

7.4.1 **Competitive pressure**

Harfoushi et al. (2016) define competitive pressure as the degree of pressure which organisations can face from their competitors in the same industry. This study defines competitive pressure as the degree of pressure the organisation experiences from its external environment, including competition from rivalries, government regulations and the amount of support received from service providers.

This research's findings show a direct positive relationship between competitive pressure and cloud computing adoption in Zimbabwe. The insights into the findings show that SMEs in Zimbabwe are not spared from the market's shrinking due to global competition. Therefore, adopting technology could be a game-changer because it is a powerful tool that can allow SMEs to compete globally.

Competitive pressures arise when competitor SMEs implement cloud computing as a competitive technology. As a result, other SMEs face stiff competition and are hence forced to adopt cloud computing to wade off the competition (J. Chiu & Liu, 2008). Furthermore, research shows that SMEs that face stiff competition tend to aggressively implement technology to maintain that competitive edge (Harfoushi et al., 2016). Surprisingly, most processes in SMEs and even at the government level in Zimbabwe are still being operated manually (Makiwa & Steyn, 2018). Thus, this research's findings should help SMEs and the government improve and make the business environment more competitive.

The research's findings show that a unit increase in competitive pressure will increase cloud adoption by a factor of 0.370 units The findings are consistent with a study by Oliveira et al. (2014). They used MLR to assess the determinants of cloud computing adoption in Portugal. Their findings show that competitive pressure increases cloud computing adoption in Portugal firms by a factor of 0.323 units. This research's findings are also consistent with other prior findings by Ali et al., (2020); Chathurika (2019) ; Gangwar et al., (2015); Harfoushi et al., (2016) and Moh'd Anwer, (2019) that confirm that competitive pressure influences greatly SMEs' decisions to adopt cloud computing. However, this research's findings contradict other studies that found no significant correlation between competitive pressure and cloud adoption (Alhammadi, Stanier, & Eardley, 2015; Skafi et al., 2020).

7.4.2 **Outsourcing Cloud services**

The quest for competitive quality services and unhindered access to data is a challenge for SMEs that have limited IT capabilities. To leverage on their lack of resources, SMEs need to outsource some of their business operations to cloud service providers. Outsource is a form of external support offered to SMEs by cloud service providers.

The findings of this research showed a surprising significant inverse relationship between outsourcing and cloud adoption. The findings seem to show that a high level of cloud adoption uncertainty owing to information asymmetries could negatively affect cloud adoption by SMEs in Zimbabwe. The results showed this factor has a negative indirect influence on SMEs' propensity to adopt cloud computing. The findings of this part of the study corroborate previous studies which found that outsourcing as an external support factor was negatively associated with adoption in SME (Alkhater et al., 2018; Alkhater et al., 2014; Alshamaila et al. 2013). Alkhater et al., 2018 and Bhuyan and Dash (2018) report that the extent of outsourcing as a form of external support depends on the size of SME, the impact of outsourcing is smaller in SMEs compared to big organisations.

Another possible explanation of the findings could be that according to Senarathna et al. (2018), the lack of knowledge and awareness in SMEs on the importance of outsourcing cloud services to cloud service providers. Outsourcing cloud services, according to Palos-

Sanchez (2017), helps SMEs to access quality and specialised support. However, SMEs worry about the security of their data being ceded to third parties (Widyastuti and Irwansyah, 2018). On the contrary, Obinkyereh (2017) argues that service providers provide better security services than the security provided on their premises. Furthermore, cloud service providers have specialised strategies to make sure that all data are backed up and securely protected (Attaran & Woods, 2019).

Research by Widyastuti and Irwansyah (2018) shows that outsourcing cloud services help SMEs to get effective service and support 24/7 because cloud computing platforms allows cloud service providers to rectify problems remotely. Moreso, outsourcing some cloud services will help SMEs to focus on their core business operations without worrying about on-premises IT resources management and maintenance costs (Senarathna et al. 2018; Harfoushi et al., 2016). Additionally, outsourcing could benefit SMEs in Zimbabwe by reducing the number of employees, and as a result, reducing company expenses and save money that could be used in research and development to improve the quality of their products and services (Widyastuti and Irwansyah, 2018).

7.4.3 **Information Intensity**

Accessibility to relevant and up to date information is an important survival tool for SMEs in this competitive global market. This study defines information intensity as SMEs' ability to access relevant, reliable, accurate and the right information as to when needed to be competitive in the environment in which they conduct their business (Chiu & Liu, 2008).

Accessibility to up to date information all the time is crucial to stay competitive in this volatile knowledge-based global economy. The findings of this research showed that there was a significant negative relationship between information intensity and cloud computing adoption by SMEs in Zimbabwe. Thus, SMEs' adoption of cloud computing in Zimbabwe depends on the degree to which SMEs can access up-to-date information. Regardless of the business type, the SME is engaged in, and the research findings showed that the ability to access up to date information influences the adoption of cloud computing. Senarathna et al. (2018) observe that cloud computing adoption allows quick access to up to date information that allows SMEs to follow market trends and make quick, informed decisions.

Chiu and Liu (2008) concur and postulate that cloud adoption enables SMEs to access up-to-date information, manage and handle a high volume of information on a daily basis. Commenting on the same issue, S. J. Yang et al. (2018) note that cloud computing affords accessibility to up to date information and allows fast access to relevant, reliable, accurate and relevant information whenever it is needed. Access up to date information places an organisation at a strategic vantage point to outcompete other SMEs because those who have reliable and up to date information should be able to control the market.

The findings of this research corroborate previous studies which reported that information intensity influences cloud adoption by SMEs (Chiu & Liu, 2008; Sadoughi, Ali, & Erfannia, 2020; Taylor, 2019; Ullah et al., 2019). However, this study's findings contradict other studies that confirm the insignificance of information intensity to cloud adoption (Ali et al., 2018; Onggo & Selviaridis, 2017; Senarathna et al., 2018).

7.5 SUMMARY

This chapter presented discussions of the research findings. The chapter discussed factors that were found to be the most influential in cloud adoption by SMEs in Zimbabwe. These factors were grouped into either technological, organisational or environmental factors. The influential technological factors were compatibility and trialability. In contrast, the size of an organisation, IT knowledge of employees and technological readiness were found to be influential organisational factors, and the influential environmental factors were competitive pressure, outsource cloud services and information intensity. The discussions also noted that SMEs, government, and other stakeholders should be aware of these influential factors for adopting cloud adoption by SMEs in Zimbabwe. The next chapter discusses the overview of the research, research reflections and contributions of the study.

CHAPTER 8 RESEARCH OVERVIEW, CONTRIBUTIONS, LIMITATIONS, FUTURE RESEARCH AND CONCLUSIONS

8.1 INTRODUCTION

In Chapter 7, the findings of the research were discussed. SMEs in Zimbabwe highlighted the factors that affect cloud adoption. The ZiCAM cloud adoption model presented in Chapter 6 was developed using these factors. The chapter reported that cloud adoption was mainly influenced by eight factors: trialability, compatibility, size of an organisation, IT knowledge of employees, technical readiness, competitive pressure, outsource cloud services and information intensity.

8.2 RESEARCH OVERVIEW

The research involves eight chapters. Research questions and objectives are outlined in chapter one. Chapter 2 discussed the design science research methodology used to develop a cloud adoption framework (ZiCAM) for SMEs in Zimbabwe. A literature review was presented in two chapters, Chapters 3 and 4. Chapter 3 presented a literature review on SMEs' importance in Zimbabwe, while Chapter 4 presented a literature review on different cloud computing adoption frameworks. Two technology adoption frameworks DOI and TOE, were adopted for the initial cloud computing adoption framework. Chapter 4 produced an initial framework in the first phase of the study. This initial cloud adoption was validated using interviews in Chapter 5. The research findings in Chapter 5 culminated in the development of an intermediate framework completing phase two of the study. Chapter 6 was phase three of the study in which the final cloud adoption framework (ZiCAM) was developed. An online survey and a statistical method were used to collect data, and MLR analysis was used to validate the results and evaluate the final artefact (ZiCAM) presented in Chapter 6. Chapter 7 discussed research findings presented in the preceding chapter. The following section reflects on the research questions for this study.

8.3 REFLECTIONS ON THE RESEARCH QUESTIONS

The primary objective of the study was the development of a cloud computing adoption framework for SMEs in Zimbabwe. This objective was answered through four sub-research questions. The main research question was formulated as **What factors should be considered when developing a cloud computing adoption framework that supports strategic decision-making for SMEs' owners when adopting cloud computing in Zimbabwe?** As already mentioned above, four sub-research questions (SRQ), in Section 1.4.1, were used to guide this research. The sub-research questions are discussed below.

- SRQ1: Why is there a need, and what the needs for SMEs to migrate their legacy systems to the cloud?

This first sub-research question (SRQ1) and the related objective (Section 1.4.2) was answered through the literature review in Chapter 3. The importance of SMEs in any economy, advantages accrued to SMEs by adopting ICT in general and cloud computing, in particular, were espoused.

- SRQ2: What current cloud computing adoption frameworks exist that support strategic decision making to adopt cloud computing and what are their shortcomings?
- SQR3: What are the main tasks and steps that SMEs should perform when making the strategic choice to adopt cloud computing as an ICT solution?

The second (SQR2) and third (SQR3) sub-research questions were addressed in Chapter 4.

- SQR4: What are the influential factors in an organisation's decision to adopt cloud computing technology in Zimbabwean SMEs?

The fourth (SQR4) sub-research question was answered in phases, starting from Chapter 4 through Chapter 5 and finally Chapter 6. In Chapter 4, factors influencing cloud computing were identified from the literature. The identified factors were used to develop the initial cloud adoption framework. This initial framework was validated using interviews in Chapter 5. The initial framework's validation process culminated into an intermediate cloud computing adoption framework presented in Chapter 5. Finally, the sub-research question was fully answered in Chapter 6. The findings from Chapter 5 were used to design an online questionnaire distributed to purposefully sampled SMEs to determine the factors that influene cloud adoption in Zimbabwean SMEs. The collected data were subjected to

MLR analysis, and the findings were then used to develop the final cloud computing adoption framework (ZiCAM) for SMEs in Zimbabwe. The following section discusses the summary of the methodology used in this study.

8.4 SUMMARY OF THE RESEARCH METHODOLOGY

DSRM was chosen to develop the ZiCAM artefact in this study, as discussed in Section 2.6. Furthermore, the reasons for choosing this methodology are discussed therein. Pragmatism as a philosophy was applied in this research. Interpretivism was used in phases one and two of the study. Phase one was literature reviews, as discussed in Chapters 3 and 4. Phase two was based on interviews, as reported in Chapter 5. Positivism was used in phase three in Chapter 6, where a questionnaire (online) was used for data collection purposes which were then analysed used MLR analysis as a statistical tool.

The following section summarises Peffers et al. (2007) DSR methodology processes as applied to this research. Peffers et al. (2007) outline six DSR methodology processes to follow when developing a DSR artefact (see figure 2.5).

8.4.1 **Problem Identification and motivation**

Global competition places enormous pressure on SMEs, especially those in developing countries, to survive in this volatile business environment (Harfoushi et al., 2016). Adopting cloud computing increases the competitive edge of SMEs and allows them to access sophisticated IT resources without capital expenditure, thereby reducing the cost of their business consumables (Harfoushi et al., 2016). The literature review showed the unavailability of cloud adoption frameworks in Zimbabwe to help SMEs adopt cloud computing and become globally competitive. Thus, this limited availability of cloud adoption frameworks in Zimbabwe acted as an impetus to this study.

8.4.2 **Define the objectives of the solution**

To develop a cloud adoption framework that would help SMEs in Zimbabwe migrate to the cloud was he main aim. The DOI and TOE frameworks were used as the foundation of this study, as discussed in Chapters 4.

8.4.3 Design and Development

In this phase, the cloud adoption framework (artefact) was developed using the MLR analysis. The identified influential cloud computing adoption factors were used to construct the ZiCAM artefact.

8.4.4 Demonstration

The demonstration consists of both descriptive and explanatory knowledge. Why an artefact work is presented through descriptive knowledge and why it works is doen through explanatory knowledge (Johannesson & Perjons, 2014). This research used explanatory knowledge to demonstrate why the artefact works (after satisfying all the conditions of MLR assumptions).

8.4.5 Evaluation

This study used a quantitative analytical approach to evaluate the framework (ZiCAM). MLR analysis, a statistical analysis tool to examine the statistical significance and magnitude of the coefficient, was used to identify how well the model fits.

8.4.6 Communication

The artefact should be presented to practitioners and researchers (Johannesson & Perjons, 2014) and to the intended users, who are the SME owners and promoters. Communication is a basic form of evaluation in which the artefact is evaluated for vigour by other researchers to make it a knowledge base for future work. Also, the novelty and utility of the artefact should be communicated to and evaluated by experts. This research will be published to create a progressive, cumulative repository knowledge base that will be used in the future as a way of communication. The following section describes the contribution of this study.

8.5 CONTRIBUTIONS OF THE STUDY

This section discusses this study's contributions, divided into four groups: theoretical, methodological, practical contributions and cultural.

8.5.1 Theoretical Contributions

This study delivered findings on the factors that influence cloud computing adoption in Zimbabwean SMEs. The study utilised the validated constructs from the DOI and TOE frameworks to see which constructs affect Zimbabwe's cloud computing adoption.

This study contributes to the growing body of knowledge in cloud adoption and the adoption of new IT innovation literature by analysing the influential factors affecting cloud computing adoption by SMEs in Zimbabwe. Some studies by Munyoka (2020), (Makiwa & Steyn, 2018) and Musungwini et al. (2016) focussed on IT adoption in Zimbabwe, and none focused on cloud adoption in SMEs. This study is the first of its kind in Zimbabwe that combined DOI and TOE frameworks to examine the influential factors affecting cloud computing by SMEs from different sectors in Zimbabwe.

This knowledge gained from this study is another significant contribution through the developed cloud computing adoption framework called the ZiCAM, as a DSR artefact. Gregor and Hevner (2013) propose different levels of positioning the nature of knowledge in DSR artefacts. They emphasise that DSR research should contribute both to practice and theory development. Table 8.1 below shows the different knowledge contribution levels of DSR espoused by Gregor & Hevner (2013).

Table 8-1: Design Science Research Types (source: Gregor and Hevner (2013:342)

	Contribution type	Examples
More abstract, complete, and mature knowledge ↕ ↕ ↕ ↕ More specific, limited, and less mature knowledge	**Level 3.** Well-developed design theory about embedded phenomena	Design theories (mid-range and grand theories)
	Level 2. Nascent design theory – knowledge as operational principles/architecture	Constructs, methods, models, design principles, technological rules.
	Level 1. Situated implementation of artefact	Instantiations (software products or implemented methods)

The table shows three levels of knowledge that DSR studies can contribute to the body of knowledge. Based on the above table, this research's knowledge contribution can be categorised as Level 2 (Nascent design) in that it represents knowledge as operational principles.

This, according to Johannesson and Perjons (2014), can also be classified as prescriptive knowledge because it consists of a framework (model) and theory. Thus, this research contributes to the theory by highlighting influential factors affecting SMEs' cloud computing adoption in Zimbabwe. The framework (ZiCAM) contributes to new knowledge by increasing awareness of factors that influence cloud computing adoption and provides an empirically evidence-based artefact that can solve problems of cloud adoption by SMEs in Zimbabwe.

Besides positioning knowledge in terms of levels, Gregor and Hevner (2013) argue that the DSR knowledge contribution can also be placed into different dimensions, as shown in Figure 8.1 below.

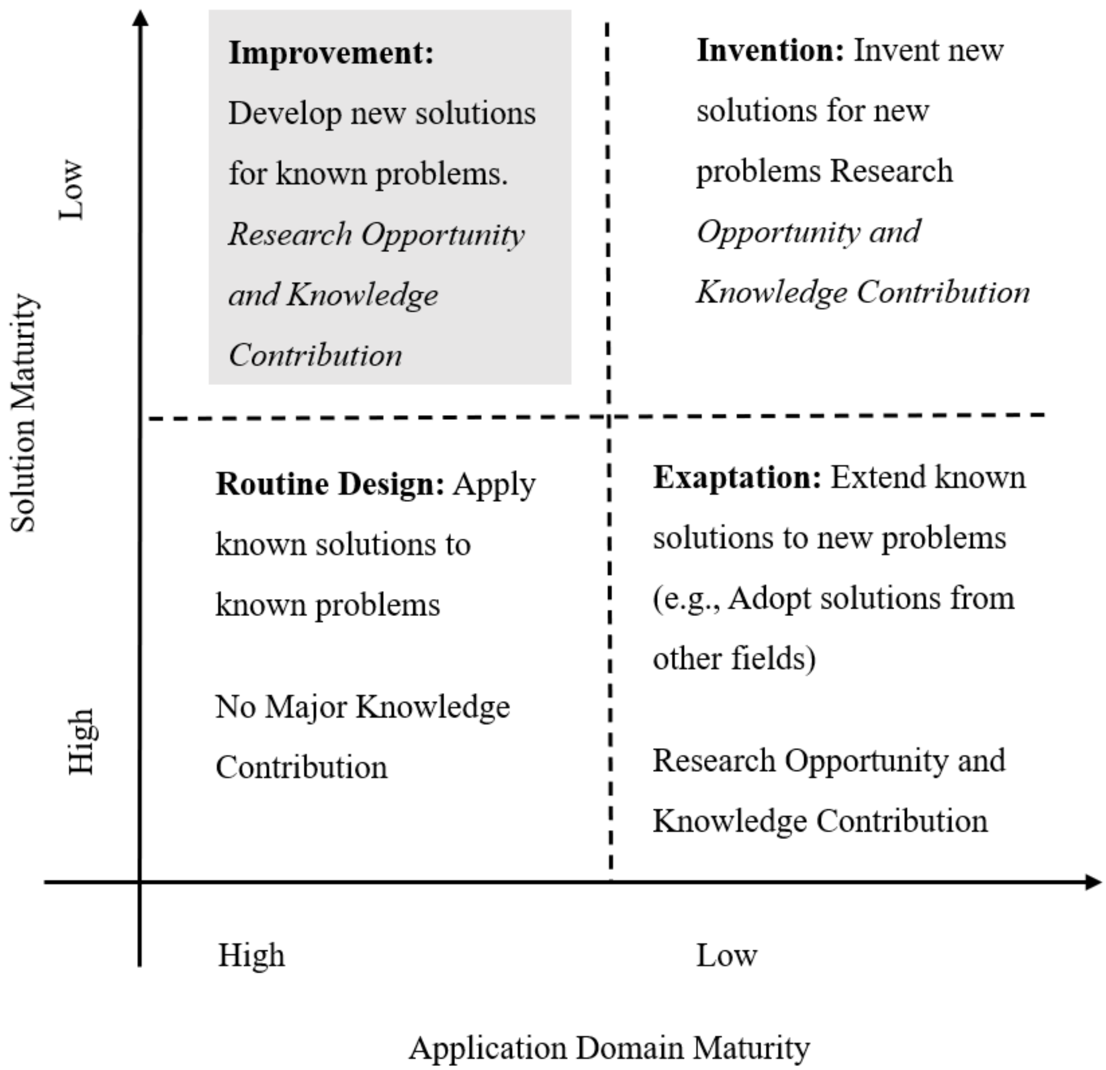

Figure 8-1: Research contribution in terms of DSR knowledge contribution framework (source: Gregor and Hevner (2013)).

The other theoretical contribution of this research, as shown in Figure 8.1 above, is in the high application domain maturity level (known problem) and low solution maturity level (new solutions). In summary, this research is situated in the improvement quadrant in which a new solution (ZiCAM) framework was developed in solving known-problems when cloud adoption frameworks for Zimbabwe is unavailable that can help SMEs to adopt cloud computing.

8.5.2 Methodological contributions

A further contribution of this study is the methodological contribution. This contribution involves developing a structured and well-defined sequenced research model that started with a literature review, a qualitative study that gave birth to a quantitative study. The research model was rigorously evaluated using MLR analysis to understand factors influencing cloud computing adoption in Zimbabwe.

Another methodological contribution was that of a new research instrument that was developed from this study. Although the fundamental questions in the survey instrument were adapted from previous studies (M. Ali et al., 2015; Alkhalil et al., 2017; Alkhater et al., 2018), modifying some questions based on the research context allowed the development of a new research instrument that will serve as an important resource for future researchers involved in cloud computing adoption studies involving SMEs..

8.5.3 Practical contributions

The cloud service providers can also benefit on a practical level, managers (owners) and the government. SMEs in Zimbabwe contribute more than 60% of GDP (Majoni et al., 2016) and thus contribute immensely to sustain the country's economy. Therefore, cloud service providers, managers (owners), and the government must know about factors affecting cloud computing adoption so that they could offer the necessary support for SMEs to grow in Zimbabwe.

8.5.4 Cultural contributions

The framework will help managers and employees understanding factors affecting cloud adoption in small and medium-sized businesses in Harare and Bulawayo and as a result, use it to build an organisational culture that will facilitate the quick adoption of cloud computing within their organisation.

The contributions are mainly for the Zimbabwean context, but some pertain to other countries as well for example the theoretical, methodological, and practical contributions can be applied in other countries. Practically, the framework’s unique components can be refined or adapted and applied in other developing countries to study the most influential factors that affect cloud computing in their contexts. The details of the implications are discussed below.

8.5.4.1 *Implications for cloud service providers*

This study's findings should help cloud service providers understand the drivers for SMEs adopting cloud computing in Zimbabwe. The research findings will help cloud service providers who are willing to explore the immature Zimbabwe cloud market to understand and appreciate the challenges being faced by SMEs regarding the adoption of cloud computing. From an informed point of view, cloud service providers will design strategies for the widespread cloud computing adoption by SMEs in Zimbabwe.

In an immature cloud market like Zimbabwe, cloud service providers should aggressively market their products to increase awareness and understand the advantages of adopting this technology. The findings of this research showed that IT knowledge of the employees affects cloud computing adoption in SMEs. Therefore, the cloud service providers must arrange workshops and seminars to share the knowledge about cloud computing and the potential benefits of adopting it to SMEs.

Trialability was also found to be an essential factor in cloud adoption by SMEs in Zimbabwe. Thus, the cloud service providers should provide adequate trial periods of the products and, at the same time, should give quick feedback to queries to allay any fears that might be inherent in their customers. This can boost trust and confidence in their customers and ultimately increase cloud computing adoption in SMEs.

Compatibility was also indicated as an influential factor when SMEs adopt cloud computing in Zimbabwe. Although this study was broad-based, including SMEs from different sectors, cloud service providers need to customise their services and make them compatible with a diverse of SMEs to increase cloud computing adoption.

8.5.4.2 *Implications for managers/ owners of SMEs*

The proposed ZiCAM cloud adoption model may help inform managers (owners) of SMEs about influential factors for cloud computing adoption in Zimbabwe. The ZiCAM could be used as a blueprint of a cloud computing adoption model to help managers (owners) minimise risks when deciding to migrate their legacy systems to the cloud. When utilised properly, this framework can make the cloud computing adoption process faster and easier for SMEs.

From the research findings, three organisational factors were important that influences the adoption of cloud computing in Zimbabwean SMEs. These factors were reported as the organisation's size, employee IT knowledge and the readiness of the technologies in organisations. The findings provide valuable information for managers (owners) to utilise and evaluate their organisations' readiness to adopt cloud computing.

Apart from increasing awareness to managers about factors that influence cloud computing adoption, utilising ZiCAM could also create a new business model that could help SMEs level competition with large corporations by accomplishing tasks faster, thereby increasing productivity. Also, of importance is that ZiCAM could help managers (owners) to adopt other new technologies in future.

8.5.4.3 *Implications for the government*

The research findings highlight some influential factors that affect cloud adoption in Zimbabwe. This could help Zimbabwe's government design guidelines, innovation, and funding schemes to help SMEs adopt cloud computing. The government should enact and implement sound policies to encourage SMEs to adopt cloud computing. As noted in Chapter 3, Zimbabwe's government needs to craft a new ICT policy, reduce the digital divide inherent in different parts of the country by improving the ICT infrastructure, electricity supply, and make sure that the Internet is not only easy to access but also affordable.

In summary, considering all the contributions mentioned above, this research provides some invaluable information for SMEs, cloud service providers, managers and the government to implement and accelerate the adoption of cloud computing in SMEs. In generalisability, the ZiCAM is a reliable and empirically evidence-based produced framework from the two DOI and TOE validated frameworks. Thus, ZiCAM has the potential of generalisability and can be applied to study cloud adoption in other regions in Zimbabwe. However, it must be used with caution because MLR analysis was used to evaluate the artefact. Research shows that MLR analysis considers as necessary only those factors that ignores variables with linear relationships to the dependent variables that form a non-linear relationship regardless of their impact on cloud adoption (Hair Jr et al., 2016). The section below highlights the study's limitations.

8.6 LIMITATIONS OF THE STUDY

Despite developing a stable and comprehensive cloud adoption framework, employing valid, reliable measures and robust statistical analysis techniques, this study has some limitations that should be considered when interpreting its findings.

Due to resource limitation (time and money) mentioned in Chapter 2, Section 2.12.1.1, the first notable limitation is the sample size used in this study. A larger sample could have given a better context of SMEs in Zimbabwe. A total of 345 participants were invited to participate in the online survey, and from that number, only 250 responses were received and ultimately, after data cleaning, the valid responses stood at 212.

This study solicited responses from decision-maker in SMEs only, and yet there could be some employees in the sampled SMEs who could have superior knowledge about cloud computing adoption but were sidelined. More insights from other stakeholders such as employees, cloud service providers and even customers could have given some significant insights from different perspectives.

The study utilised SMEs that are registered with the Small and Medium Enterprises Association of Zimbabwe (SMEA-ZW), and yet other SME associations (for example, Association for Business Zimbabwe (ABUZ) could have provided deep and better insights into the research.

Geographically, this study utilised SMEs that were purposefully selected from different economic zones in the two cities, Harare and Bulawayo in Zimbabwe. Thus, this may limit the generalisability of this research's results to the whole population of SMEs in Zimbabwe or any other country. Therefore, there is a need to carry out further empirical investigations in all the other provinces to have a broader perspective and a better representative picture of factors that influence SMEs' cloud computing adoption.

The variables used to construct the framework were adapted from the validated DOI and TOE frameworks. The two frameworks were selected because they are perceived to represent the key factors that can potentially affect the SMEs' propensity to adopt cloud adoption. Thus, this research's findings should be interpreted with caution as other potentially influential factors like organisational culture, availability of service providers, individual characteristics of participants, political and economic development levels were not factored in the study.

Another limitation is the use of MLR analysis methods to extract the most influential factors affecting SMEs' cloud adoption. As already mentioned above, MLR analysis extricates only the variables that have a linear relationship with the dependent variable. Non-linear variables, even if they are potentially key factors in cloud computing adoption, are not included in the MLR analysis equation.

Lastly, the ZiCAM framework is presented at a conceptual level, and further work is needed to guide the operationalisation of the framework. Thus, following Gregor and Hevner (2013) recommendation, there is a need for an appropriate strategy for communication of the work to reach out to the greater audience to enhance its uptake.

These limitations discussed above open the door for further research in the future. Some recommendations for future research directions are presented below.

8.7 FUTURE RESEARCH

This study used a cross-industry sample involving SMEs from the industry's different sectors, and these have different fears and expectations when adopting cloud adoption. It is recommended that in future, a study whose focus will be on a single line industry could probably draw exciting results. Such a study could bring vigour and useful industry-specific perspectives.

The study sought responses from decision-makers in SMEs. Future research should endeavour to collect responses from various people within SMEs, including cloud services providers, employees and customers, to get richer insights and different perspectives to develop a better and broader cloud computing adoption framework. An App should be developed to assist SMEs in Zimbabwe to adopt cloud computing.

Even though this study focussed on SMEs in Harare and Bulawayo, the ZiCAM framework may in future studies, provide a bedrock theoretical foundation for further studies on cloud computing adoption in SMEs in Zimbabwe. In addition, given the dynamic nature of the technological landscape, it is important to keep in mind that the factors that influence the adoption of technology at a particular time can change over time. It will be interesting to learn whether ZiCAM could be used in future studies to extricate the new factors affecting the adoption of new technology. Additionally, more robust multivariate statistical tools should be used to analyse complex models to extricate both linear and non-linear variables that influence cloud computing adoption in SMEs, thus producing a more representative good fit model.

Although the online survey provided data to develop the ZiCAM framework, there is a need to apply large-scale longitudinal research to understand influential factors in cloud computing adoption better.

The findings highlighted that some factors that were found to be significant in earlier studies were insignificant in this study. These factors are relative advantage, security, complexity, top management support, cost saving, government regulations and external support. It will be interesting if future studies could find why these factors were found to be insignificant in this study. The following section describes the researcher's personal experiences and reflections on his journey to complete this thesis.

8.8 PERSONAL REFLECTIONS

Embarking on the PhD journey was a rollercoaster in my life, both in terms of a research journey and personal life. This section reflects on some personal reflections on their journey.

When I started my PhD journey, I was very excited. I felt inspired and empowered to become whomever I wanted to be, perhaps a top executive chairperson of a blue-chipped organisation seating in a meticulously furnished office sipping some cup of coffee chairing an executive meeting. I felt bright-eyed and bushy-tailed when I started my PhD journey. However, these great feelings fizzled out during the course of the journey. I began to harbour feelings of inadequacy and self-doubt because of the rough terrain of the path. The journey was tortuous, exhaustive but surmountable. The words of Guest (1921) from his poem *Don't Quit* kept me strong. He says in the first stanza, "When the road you are trudging seems all uphill, rest if you must, but don't you quit." The words in the third stanza, "It may be near when it seems so far, so stick to the fight when you are hardest hit…" kept on ringing in my mind and gave me that impetus to continue to push and complete the journey.

A poem by Frost (1963) called *The Road Not Taken* was profound to me during my PhD journey. The last stanza says, "… two roads diverged in a wood, and I took the one less travelled by and that has made all the difference in my life." Indeed, the road less travelled might be tortuous, but I am happy I chose that road, and it has made a difference in my life. The superb support from my supervisors and my immediate family helped me to stay on course. I empathised with my family during the PhD journey because they did not understand my journey's terrain. It was indeed a difficult journey, especially when I had to deal with other competing duties that had to be fulfilled. Being a husband, father, friend, full-time employee, and a student made this journey difficult. At work, it is mandatory to complete four hours of mandatory professional development courses every week. The courses demand much reading, thus diverting my attention and taking a lot of my study time.

It is also essential to understand that researchers are like voyagers who embark on a journey from a familiar comfort zone to unknown territories. In most cases, the voyager does not know the terrain of the landscape, but they always carry that ray of hope that they will eventually reach their destination one day. As they journey, they will encounter new horizons that may cause fundamental transforms in their life. Scales of prejudices and academic blindness may begin to fall off from the eyes of one's mental faculties as they start to see new perspectives about who they are (ontology) as well as what they know (epistemological).

As a researcher continues to journey, sometimes they are likely to encounter strong turbulence that might change the course of their journey. As they indulge in more reading, the turbulences may come in contradicting and conflicting arguments. Indulgence in these arguments can bring anxiety and confusion in the researcher's mind, a state known as cognitive dissonance. Although this may seem so overwhelming, I learned to be patient and never keep my eyes off the ball as a researcher. The African proverb, patience can cook a stone helped me be strong and remained focused on successfully reaching my destination.

Encountering the contradicting and conflicting arguments from literature challenge our familiar and comfortable assumptions, and as a result, they may become the steppingstones to new knowledge and understanding. To be able to learn and appreciate new ideas, one has to borrow the words of Descartes, Haldane, and Ross (1993, p. 12) when he says, "I realise that it was necessary, once in the course of life, to demolish everything and start from the new foundations…" However, this is easier said than done because human beings as all other things in nature suffer from mental inertia. It is inherently challenging to untangle and break habits of thoughts that are so profoundly entrenched in our inner being. As a researcher, one must positively engage with new knowledge frontiers and be willing to be transformed.

Completing this PhD journey can be compared to the character Odysseus in the book *The Odyssey*. After years of struggles and tribulations, Odysseus, the main character, was emaciated and physically unrecognisable upon returning home after years of struggles and tribulations. Phenotypically, his appearance had drastically changed. This same experience of Odysseus can be compared to someone who embarks on a PhD journey. Of course, writing a thesis for many years may not cause a drastic change in the outward appearance, but there is a profound and significant change in the inner being.

My PhD journey experience can be aptly summarized by words from Batchelor and Di Napoli (2006, p. 16) when they say, "The traveller who returns from a journey cannot be unchanged, preserved as s/he was at the moment of departure…" Indeed, after embarking on this PhD journey through uncharted waters, a significantly transformed inner being is a new inner feeling.

The following section highlights some lesson learnt from this PhD journey.

8.9 LESSONS LEARNT

This section describes some lessons that were learnt from doing the research.

I have acquired a deeper understanding of the challenges faced by the manager (owners) when adopting cloud computing. I have developed an interest in establishing my own SME that will offer consultancy services to other SMEs and even large corporations to help them with strategic planning to adopt cloud computing.

From the research findings, it is apparent that cloud computing adoption by SMEs is still shallow, partly due to the following reasons:

- Poor IT infrastructure
- Lack of electricity to power SMEs
- Low IT skills in both the decision-makers in SMEs and the employees.
- Unaware that cloud computing exists
- The high cost of data
- The vast digital divide among different SMEs
- No, IT policy to drive the cloud computing adoption agenda.

Another lesson learnt from this study is the use of DSR methodology. DSR methodology focuses on developing artefacts that solve human problems. Before this study, I had limited knowledge and experience of using DSR methodology in research. I want to thank my supervisors, who introduced me to this methodology, took my hand and helped me walk through it with ease.

I also learnt that studying towards a PhD is a long haul and arduous journey that passes through deep valleys of self-doubt and vast mountains of frustrations. One needs to gird themselves up, carefully plan, build up enough stamina to persevere at different phases of the journey. However, all this may be a futile exercise if one does not have a solid support base. I had a strong support base from my supervisors, who, after submitting a task, they would promptly work through it and give it back with constructive feedback.

Finally, I would want to end by saying that "…there is nothing new under the sun…" (Ecclesiastes 1:9 KJV), thus what might seem like an insurmountable journey, it always important to remember that there is someone who might have taken the same road before. Thus, the lesson learnt can be aptly summarised using Sir Newton's (1675) words that say, "…if one wants to see further, they must stand on the shoulders of giants." I stood on the shoulders of my supervisors, and I can now see far. It was an important lesson that I learnt from this PhD journey. The next section concludes the research.

8.10 CONCLUSION

In Zimbabwe the adoption of cloud computing in SMEs, is still nascent. The study aimed to develop a cloud computing adoption framework to assist SMEs in Zimbabwe to migrate their legacy systems to the cloud. DSR methodology was used to develop the framework (ZiCAM). A sample of 212 was drawn from decision-makers in sampled SMEs from Harare and Bulawayo in Zimbabwe.

The use of MLR analysis provided statistical evidence of the significant relationship between cloud computing adoption (dependent variable) and these eight independent variables (compatibility, trialability, size of an organisation, technological readiness, IT knowledge of employees, competitive pressure, outsource cloud-services and information intensity). Thus, these eight factors can have an affect on how Zimbabawe adopt cloud computing.

An attempt was made to highlight factors affecting cloud adoption in Zimbabwe through the study. Besides theoretical and methodological contributions, this research's results help bring awareness to stakeholders (cloud service providers, managers (owners) and the government) of the critical factors in cloud computing adoption in Zimbabwe. Using ZiCAM may assist in accelerating cloud adoption by SMEs in Zimbabwe.

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Appendix A : Ethical Clearance Certificate

UNISA university of south africa

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

19 March 2020

Ref #: 025/RTS/2019/CSET_SOC
Name: Mr Richard Tawanda Shoniwa
Student #: 49129872

Dear Mr Richard Tawanda Shoniwa

Decision: Ethics Approval for 5 years
(Humans involved)

Researchers: Mr Richard Tawanda Shoniwa, 1642 Mahatshula North, Bulawayo, Zimbabwe, +263 77 237 0908, + 971 52 618 0976, 49129872@mylife.unisa.ac.za, +27 81 335 7617

Project Leader(s): Prof M Herselman, mherselman@csir.co.za, +27 12 841 3081
Prof Adele Botha, abotha@csir.co.za, +27 12 841 3265

Working Title of Research:

Developing a Framework for Adoption of Cloud Computing by Small Medium Enterprises in Zimbabwe

Qualification: PhD in Information Systems

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 five years, from 19 March 2020 to 19 March 2024.

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 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.

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

The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.

3. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
4. 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. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
5. 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 requires additional ethics clearance.
6. No field work activities may continue after the expiry date (19 March 2024). Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number 025/RTS/2019/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

Dr. B Chimbo

Chair: Ethics Sub-Committee SoC, College of Science, Engineering and Technology (CSET)

Type text here

Prof E. Mnkandla

Director: School of Computing, CSET

Prof B. Mamba

Executive Dean: CSET

Approved - decision template – updated Aug 2016

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

Appendix B : Questionnaire

ADOPTION OF CLOUD COMPUTING BY SMEs

Developing a Framework for Adoption of Cloud Computing by Small Medium Enterprises in Zimbabwe

Dear Prospective participant,

You are invited to participate in a survey conducted by **Tawanda Richard Shoniwa** under the supervision of **Prof Marlien Herselman** a Professor in the Department of Information Systems towards a PhD at the University of South Africa.

The aim of the survey to develop a cloud computing adoption framework that will help SMEs in Zimbabwe to be globally competitive by adopting cloud computing in their business.

You were selected to participate in this survey because you are a manager/ owner/ or decision-maker in your SME. Your views and perceptions on the statements outlined in the survey questionnaire will help us understand your organisation's perspective on the issue under study and ultimately help us to develop a cloud computing adoption framework that can be used by SMEs in Zimbabwe. 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.

The survey is developed to be anonymous, meaning that we will have no way of connecting the information that you provide to you personally. The information you will provide will only be reported in an aggregated form, which means your SME will not be identifiable in any related research output. Once you have read this form and decide to participate, please click the '**Next Button**' to start the survey. The survey comprises 28 questions and will require approximately 15 to 25 minutes to complete. When you have completed the survey, please press or click the 'Submit' button to submit your responses. **By pressing the OK or SUBMIT button you are indicating that you accept and consent to take part in the survey.**

If you require additional information or have questions, please feel free to contact me during office hours on **+263 772 370908 or 49129872@mylife.unisa.ac.za.** Alternatively, you can contact my supervisor **Prof. Marlien Herselman** during office hours on **+27 12 841 3081 or MHerselman@csir.co.za.**

Thank you for your participation.

Yours Sincerely

Tawanda R. Shoniwa

School of Computing
Faculty of Science Engineering and Technology (University of South Africa)

Instructions

Answer all questions.

- For each question read all options first and then indicate by putting a tick (**✓)** on your chosen answer.
- Where you need to fill in, please write legibly.
- There are no right answers to these questions – we value your opinion. All the answers obtained from this research will be used for this research only.
- Your responses are confidential, and no name of SME or owner will be published we, therefore, kindly ask you to give your honest answers.

GENERAL INFORMATION

1. What is your gender? Male [1] Female [2] I would rather not say [3]
2. What is your age? _____

3. What is your position in the SME?

Owner	1
Manager	2

Other, Specify______________________________

4. What is your highest level of education?

Primary school	1
Secondary school	2
Diploma	3
First degree/Bachelors	4
Master's degree	5
Doctoral degree	6
Other (specify)	7

5. What is your type of business (select one)?

Communication	1
Construction	2
Farming	3
Pharmaceuticals	4
Textile & Clothing	5
Grocery/ Food processing	6
Chemical/ Electrical products	7
Manufacturing	8
Carpentry & Wood curving	9
Finance	10
Transport	11
IT	12
Other (specify)	13

6. How many employees do you have in your SME? __________________________ employees
7. How many years has your enterprise been operational? ___________________ years
8. Which of the following best describes your SME's market sphere? *(Tick all that apply)*

		NO	YES
8.1	Local market	0	1
8.2	National market	0	1
8.3	Regional market	0	1
8.4	International market	0	1

9. What cloud-based applications are being used by your organisation? *(Tick all that apply)*

		NO	YES
9.1	Email	0	1
9.2	Email marketing	0	1
9.3	Web conferencing	0	1
9.4	Collaboration Software	0	1
9.5	File storage and sharing	0	1
9.6	E-Commerce processing	0	1
9.7	Other (specify)------------------------------	0	1

10. The following statements on a scale 1 to 5 capture the technological factors of using cloud computing in your organization. Using a tick (✓) rate the following statements from Strongly Disagree to Strongly Agree, where “Strongly Agree” means the statement applies to you and “Strongly Disagree” means the statement does not apply to you.

TECHNOLOGICAL FACTORS						
RA	**Relative Advantage**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
RA1	Adopting cloud computing would allow us to use the latest version of the technology.	1	2	3	4	5
RA2	Using cloud computing would allow better communication with our suppliers and customer.	1	2	3	4	5
RA3	Using cloud computing would allow us to penetrate new markets.	1	2	3	4	5
RA4	Using cloud computing would make it easier for us to do our job.	1	2	3	4	5
RA5	Cloud computing would enhance our company’s data storage capacity.	1	2	3	4	5

	TECHNOLOGICAL FACTORS					
CP	**Compatibility**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
CP1	Cloud computing is NOT compatible with other systems that we are using.	1	2	3	4	5
CP2	Cloud computing can easily be integrated into our existing IT infrastructure.	1	2	3	4	5
CP3	Using cloud computing is compatible with our company's business model.	1	2	3	4	5
CP4	Using cloud computing fits well into our company's work style.	1	2	3	4	5
CP5	We would use cloud services if they were consistent with our needs.	1	2	3	4	5

	TECHNOLOGICAL FACTORS					
S	**Security**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
S1	Cloud computing provides a sufficient security transfer channel during the process of mass data interchange.	1	2	3	4	5
S2	Using cloud computing system solutions are trustworthy.	1	2	3	4	5
S3	Cloud provider data centres provide greater security of data.	1	2	3	4	5
S4	Cloud provider data centres have effective backup systems.	1	2	3	4	5
S5	Security, in general, is a critical issue that affects our decision to use cloud services.	1	2	3	4	5
S6	I feel that cloud computing is not secure enough to store our organisation’s data.	1	2	3	4	5

	TECHNOLOGICAL FACTORS					
CX	**Complexity**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutra l	Agree	Strong ly Agree
CX1	Working with cloud computing is complicated, it is difficult to understand what is going on.	1	2	3	4	5
CX2	It takes too long to learn how to use cloud computing to make it worth the effort.	1	2	3	4	5
CX3	Learning to operate the cloud computing system is easy for me.	1	2	3	4	5
CX4	It takes too much time for me if I want to use cloud computing to do my normal duties.	1	2	3	4	5
CX5	In general cloud computing is very complex.	1	2	3	4	5

TECHNOLOGICAL FACTORS						
C	**Cost**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
C1	Cloud computing decreases the investment in new IT infrastructure in our organisation.	1	2	3	4	5
C2	Cloud computing eliminates the cost of upgrading the IT system in our organisation.	1	2	3	4	5
C3	Deploying cloud computing involves high costs.	1	2	3	4	5

C4	Costs of using the Internet are very high in Zimbabwe.	1	2	3	4	5
C5	Cost of high bandwidth and availability of the internet will be an issue for my organisation's decision to adopt cloud computing.	1	2	3	4	5

	TECHNOLOGICAL FACTORS					
T	**Trialability**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
T1	I have a great deal of opportunity to try various types of cloud computing.	1	2	3	4	5
T2	I am permitted to use cloud computing on a trial basis for long enough to see what it could do.	1	2	3	4	5
T3	Cloud computing is available to me to adequately test run various applications.	1	2	3	4	5
T4	Being able to use cloud technology on a trial basis will encourage us to adopt it in our organisation.	1	2	3	4	5
T5	It is necessary to know how to deal with the services of cloud computing before deciding to adopt it.	1	2	3	4	5

11. ORGANISATIONAL FACTORS

The following statements on a scale 1 to 5 capture the organisational factors of migrating to cloud computing in your organisation. Using a tick (✓) rate the following statements from Strongly Disagree to Strongly Agree, where "Strongly Agree" means the statement applies to you and "Strongly Disagree" means the statement does not apply to you.

	ORGANISATIONAL FACTORS					
TMS	**Top Management support**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
TMS1	Top management is willing to take the risks (financial and organisational) involved in adopting cloud computing.	1	2	3	4	5
TMS2	Top management understands the benefits of cloud computing in our organisation.	1	2	3	4	5
TMS3	Top management is seriously considering the adoption of an appropriate cloud system in my organisation.	1	2	3	4	5
TMS4	Top management provides resources to support the adoption of cloud computing.	1	2	3	4	5
TMS5	The decision to adopt cloud services in our organisation depends on top man agement.	1	2	3	4	5

	ORGANISATIONAL FACTORS					
SO	**SIZE OF ORGANISATION**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SO1	The number of employees in my organisation is high compared to others in the industry.	1	2	3	4	5
SO2	Small organisations are more flexible in adopting cloud computing.	1	2	3	4	5
SO3	The revenue of my organisation is high compared to others in the industry.	1	2	3	4	5

SO4	Bigger organisations with larger resources can easily move to adopt cloud computing.	1	2	3	4	5
SO5	The size of an organisation impacts its adoption of cloud computing.	1	2	3	4	5
	ORGANISATIONAL FACTORS					
TR	**TECHNOLOGICAL READINESS**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
TR1	Having a robust technical infrastructure (e.g., high bandwidth) would enable us to use cloud technology.	1	2	3	4	5
TR2	Having a fast Internet connection would encourage us to adopt cloud technology.	1	2	3	4	5
TR3	Having the necessary technical skills would enable us to use cloud technology.	1	2	3	4	5
TR4	We still lack in technical skills of using cloud technology in our organisation.	1	2	3	4	5
	ORGANISATIONAL FACTORS					
IKE	**IT knowledge of employees**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
IKE1	The IS staff in my organisation can support cloud computing systems development.	1	2	3	4	5
IKE2	Organisations with employees who have more knowledge about cloud computing are likely to adopt it.	1	2	3	4	5
IKE3	The level of knowledge about cloud computing within the organisation is low.	1	2	3	4	5
IKE4	All my employees have basic knowledge about cloud computing.	1	2	3	4	5
IKE5	All of my employees have already used cloud computing (personal use/ business purposes).	1	2	3	4	5

IKE6	Having at least one employee who has a formal qualification in the use of cloud computing is important for my company.	1	2	3	4	5

12. ENVIRONMENTAL FACTORS

The following statements on a scale 1 to 5 capture the environmental factors of using cloud computing in your organization. Using a tick (✓) rate the following statements from Strongly Disagree to Strongly Agree, where

"Strongly Agree" means the statement applies to you and “Strongly Disagree” means the statement does not apply to you.

ENVIRONMENTAL FACTORS						
GR	**Government Regulation**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
GR1	The government effectively promotes cloud computing adoption in SMEs.	1	2	3	4	5
GR2	The data protection policies are regulated by the government.	1	2	3	4	5
GR3	Government regulations can provide a better process for adopting cloud computing.	1	2	3	4	5
GR4	Current government policy is focused on data privacy.	1	2	3	4	5
GR5	Current government policy is focused on data security.	1	2	3	4	5
GR6	There is no specific government policy on the adoption of cloud computing.	1	2	3	4	5

ENVIRONMENTAL FACTORS						
COM	**Competitive Pressure**	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
COM1	Our main competitors have adopted cloud computing.	1	2	3	4	5
COM2	Our competitors who adopted cloud computing appear to have benefited greatly.	1	2	3	4	5
COM3	I think that cloud computing influences competition in their industry.	1	2	3	4	5
COM4	Our firm is under pressure from competitors to adopt Cloud Computing.	1	2	3	4	5
COM5	Our competitors who adopted cloud computing are favoured by our clients.	1	2	3	4	5

ENVIRONMENTAL FACTORS						
II	**Information Intensity**	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
II1	The users and organisations in the same industries as my organisation rely on each other for information regarding services.	1	2	3	4	5
II2	Users have access to sufficient information on how to use services.	1	2	3	4	5
II3	Organisations in the same sector as my organisation can access sufficient information to support a change in services provided.	1	2	3	4	5
II4	My organisation is dependent on up-to-date information.	1	2	3	4	5
II5	It is very important for my organisation to access information fast, whenever we need the information	1	2	3	4	5

II6	My organisation needs to have access to reliable, relevant and accurate information.	1	2	3	4	5

	ENVIRONMENTAL FACTORS					
ES	**External Support**	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
ES1	Our company receives excellent technical support from the cloud provider.	1	2	3	4	5
ES2	Our company receives training on a scheduled basis from cloud providers.	1	2	3	4	5
ES3	Cloud computing enables us to outsource IT services and focus on our competencies.	1	2	3	4	5
ES4	Having sufficient support from the cloud provider would encourage us to use cloud technology.	1	2	3	4	5
ES5	Our cloud service provider allows us to switch to another provider easily.	1	2	3	4	5

13. The following statements on a scale 1 to 5 capture the likelihood of your organisation to adopt cloud computing Using a tick (✓) rate the following statements from Strongly Disagree to Strongly Agree, where “Strongly Agree" means the statement applies to you and "Strongly Disagree" means the statement does not apply to you.

CD	CLOUD ADOPTION	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
CD1	I am willing to use cloud computing technology in my organisation.	1	2	3	4	5
CD2	My organisation is committed to adopting cloud computing within the next 12 months.	1	2	3	4	5

CD3	I am currently using cloud computing in my business.	1	2	3	4	5
CD4	I have already adopted some cloud computing services.	1	2	3	4	5
CD5	The organisation is currently engaged with cloud computing adoption.	1	2	3	4	5
CD6	My organisation will likely take steps to adopt cloud technology in the future.	1	2	3	4	5

14. What are the top drivers of cloud computing adoption in your SME (organisation)?

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15. What reasons could prompt your organisation to adopt cloud computing?

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16. What are main issues that worry you most about your SME adopting cloud computing?

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17. Please provide any additional comments that you feel may be important for your SME to adopt cloud computing?

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Thank you for completing the questionnaire.

The End.

Appendix C : Interview Protocol

The interview phase was designed to answer the sub-research question 4 (SRQ4) What are the influential factors in an organisation's decision to adopt cloud computing technology in Zimbabwean SMEs? The results from the qualitative phase will be used to develop the questionnaire for the quantitative phase. The qualitative phase will involve structured interviews with participants to obtain their perceptions on factors affecting cloud computing adoption in their SMEs.

The following are the themes established from the literature and used as the interview guide to extrapolate data from the participants. To what extent do you AGREE or DISAGREE with the following scales of constructs?

Constructs	**Scales**	**Adapted source**
Compatibility	Using cloud computing is compatibility with our system. Cloud computing is easily connected with the existing communication network of my SME. Cloud computing is compatible with my SME's values and values	Ifenedo (2011); Kim and Lee (2008); Lian et al., (2014); Premkumar and Roberts (1999); Thiesse, et al., (2011)
Cost	Cloud computing reduces upfront capital investments. Maintenance costs of the will be very low when we adopt cloud computing.	Kuan and Chau (2001); Lian et al., (2014) and Premkumar and Roberts (1999)
Complexity	Using cloud computing is too complicated for operations in my SMEs. Cloud computing is too complicated for my employees.	Lian et al., (2014); Premkumar and Roberts (1999); Thiesse, et al., (2011)

Security Issues	Cloud computing system is trustworthy. Cloud computing provides enough security for our data	Ghazil, et al., (2017); Senyo et al., (2016); Lian et al., (2014) Soliman and Janz (2004).
Trialability	We need to have a trial run of the cloud computing system before deciding to adopt it.	Walker, et al., (2019); Younes (2017); Emani, et al., (2018)
Top Management support	Top management should provide resources for the SME to adopt cloud computing. The decision to adopt cloud computing depends on top management	Skafi, et al., (2020); sandu and Gide (2018); Martins, et al., (2017); Kumar, et al., (2017); Amini and Bakri (2015); Oliveira and Martins (2015)
Uncertainty	We do not know how the cloud computing system functions. Uncertainty is a critical factor to adopt cloud computing	Senarathna, et al., (2018); Senyo, et al., (2016); Al-lawati and Al-Badi (2016)
Trust	Cloud computing is trustworthy to keep our data. Trustworthy is the most crucial factor in cloud computing adoption	Martins, et al., (2019); Matias and Hernandez (2019); Hsu, et al., (2015); Trinh, et al., (2015)
Observability	Observability is a very important factor in cloud adoption. We can be attracted to adopt cloud computing when we observe others using it.	Sayginer and Ercan (2020); Yeh (2019); Chiu-Yu, et al., (2017); Hsu and Lin (2015)
Technological Readiness	Our SME has IT infrastructure to adopt cloud computing. We have the skills to run cloud adoption in our SME.	Nasser and Jawad (2019); Yoo and Kim, (2018); Al-Shboul, (2018); Kandil et al., (2018); Senyo et al., (2018)
Age of firm	The new firm has a better chance to adopt cloud computing.	BEIS Report, (2019); Lu, et al., (2019); Abdulla, et al., (2018); Badi, et al., (2017)

	Old firms can adopt cloud computing faster than small firms.	
Innovativeness of firm	More innovative firms adopt cloud computing faster.	Emani, et., (2018); Wang, (2016); MaClenman and Van Belle, 2014)
Size of organisation	Number of employees in your SME What is your business turn over?	Bhuyan and Dash (2018); Senarathna, et al., (2018); Widyastuti and Irwansyah (2017).
IT knowledge of employees	Employees in my SME can support cloud computing. SMEs with skilled employees can adopt cloud computing faster.	Prause, (2019); Sandu and Gide, (2019); Chathurika (2019); Lin and Lin (2008).
Government Regulations	Government promotes cloud computing adoption. Government formulated data protection policies to safeguard our data.	Ali and Osmanaj, (2020); Taylor, (2019); Alhammadi, (2016); Rault, et al., (2017);
Competitive Pressure	When we adopt cloud computing, we become better than our competitors. Our main competitors have adopted cloud computing.	Ali and Osmanaji (2020); Skafi, et al., (2019); Chathurika (2019); Al-Shboul (2018);
Information Intensity	Our SME is dependent on up to date information to function. Cloud computing provides us with up to date information.	Taylor, (2019); Ullah et al.,(2019); Sadoughi et al., (2020); Chiu et al., (2017)
External Support	External support encourages us to adopt cloud computing. Training from cloud service providers encourages us to adopt cloud computing.	Skafi, et al., (2019); Ullah, et al., (2019); Widyastuti and Irwansyah, (2017); Kumar, et al., (2017)
Industry	Cloud adoption depends on the type of SME. Our SME is not suited to cloud computing adoption	Sayginer and Ercan, (2020); Lu et al., 2019; Alceanea and Wainwright, (2014)