

https://dspace.org/

Factors that influence the adoption of cloud computing by SMMEs in Gauteng townships in South Africa

Manaka, Michael

2025

University of the Witwatersrand, Johannesburg

https://hdl.handle.net/10539/47762

Manaka, Michael . (2025). Factors that influence the adoption of cloud computing by SMMEs in Gauteng townships in South Africa [Master`s dissertation, University of the Witwatersrand, Johannesburg]. WIReDSpace. https://hdl.handle.net/10539/47762

Downloaded from a DSpace repository. https://dspace.org/



Factors that influence the adoption of cloud computing by SMMEs in Gauteng townships in South Africa

Michael Manaka
Wits Business School

Supervisor: Dr Jabulile Msimango-Galawe

The research article is presented in partial fulfilment for the degree of Master of Business Administration to the Faculty of Commerce, Law, and Management, University of the Witwatersrand

July 2024

Supporting Documents

Name of candidate	Michael Manaka
Student number	9404687M
Name of supervisor	Dr Jabulile Msimango-Galawe
Proposed journal	The South African Journal of Entrepreneurship and Small Business Management
Word count*	18337

* excluding references and appendices

Declaration

I, Michael Manaka, declare that this research article entitled '**Factors that influence the adoption of cloud computing by SMMEs in Gauteng townships in South Africa**' is my own unaided work. I have acknowledged, attributed, and referenced all ideas sourced elsewhere. I am hereby submitting it in partial fulfilment of the requirements for the Master of Business Administration degree at the University of the Witwatersrand, Johannesburg. I have not submitted this report before for any other degree or examination to any other institution.

Michael Manaka

Signed at Johannesburg on 20th July 2024

Acknowledgements

First and foremost, I would like to thank Almighty God for granting me the strength, wisdom, and perseverance needed to complete this work. Without His blessings, none of this would have been possible.

I am deeply indebted to my supervisor, Dr Jabulile Msimango-Galawe, whose guidance, insightful feedback, and encouragement have been invaluable throughout this research process. Your expertise and patience have been crucial to my development as a researcher.

I would also like to extend our deepest appreciation to the SMME owners and managers in Gauteng townships who participated in the research and provided invaluable insights into their experiences with cloud computing adoption.

To the various syndicate groups I have been a part of during this journey, thank you very much. Your camaraderie, intellectual exchanges, and unwavering support have been a source of inspiration and motivation.

This work is dedicated to the memory of my late father, Alfred Madimetja Manaka. Your teachings, values, and dreams have always been a guiding light in my life. I miss you dearly and hope this work makes you proud. I also wish to honour the memory of my late brother, Johannes Lesiba Manaka, and my late sister, Rebecca Appies. Your legacy and the values you instilled in me have been a constant reminder that hard work pays off ultimately.

To my mother, Linah Raisibe Manaka, thank you for your endless love, prayers, and encouragement. Your jokes came in handy when I had a mental block. I love you lots.

To my siblings: Sarah, Annah, Priscilla, Joyce, Constance, Miriam, and Peter, your unwavering support and belief in my abilities have always pushed me to strive for excellence. I am grateful for each one of you.

To my beloved wife, Mmakwena Salome Manaka, your love, patience, and understanding have been my rock. Thank you for standing by me through all the

challenges and sacrifices. Your unwavering support has made this journey possible.

To my children, Thakgalang, Rethakgetše, and Kgodiso, you are my greatest joy and inspiration. Your smiles and love have been a constant reminder of the importance of perseverance and hard work.

Finally, I would like to acknowledge my employer, Standard Bank of South Africa, for providing me with the resources and time necessary to pursue this research. Your support has been instrumental in enabling me to balance my professional and academic responsibilities.

Thank you to everyone who has contributed to this journey. Your support and encouragement have been truly invaluable.

ABSTRACT

Background: Recently, there has been a growing emphasis on supporting small, medium, and micro enterprises (SMMEs) operating in township economies. To provide effective support, it is crucial to understand the contextual factors that influence technological advancements and business performance.

Aim: This study aimed to investigate the extent to which contextual factors influence the adoption of cloud computing technology in SMMEs located in the townships of Gauteng Province, South Africa.

Setting: The study focussed on SMMEs in Gauteng Province's townships.

Methods: The study employed a quantitative research methodology, collecting data from 56 respondents through online and paper-based questionnaires. The hypothesis testing was conducted using multilinear regression analysis.

Results: The study revealed that contextual factors have a negligible influence on the adoption of cloud computing by SMMEs in Gauteng townships. Contrary to the initial hypotheses, IT infrastructure, government initiatives, and political stability did not significantly affect cloud adoption. However, electricity supply was found to have a significant negative impact.

Conclusion: The study found that contextual factors exert minimal influence on cloud computing adoption. These findings call for a re-evaluation of current support strategies and underscore the need for further research to uncover the nuanced factors affecting cloud computing adoption in similar contexts.

Contribution: This study contributes to the broader conceptual frameworks of technology adoption by SMMEs, and can be utilised by various practitioners, including academia, policymakers, SMME owners and managers, and strategic management researchers, to improve growth and sustainability.

Keywords: contextual factors, cloud computing, SMME, Gauteng, township

TABLE OF CONTENTS

Supporting Documents ii

Declaration iii

Acknowledgements iv

ABSTRACT vi

LIST OF TABLES xi

LIST OF FIGURES xii

LIST OF ACRONYMS xiii

1. INTRODUCTION 1

1.1 Context of the study 1
1.2 Problem statement 2
1.3 Aim and objectives 2
1.4 Significance of the study 3

2. LITERATURE REVIEW 6

2.1 Introduction 6
2.2 Small Medium and Micro Enterprises (SMMEs) 6
2.3 Cloud Computing 7
2.4 Benefits of Cloud Computing 9
2.5 Cloud Computing Challenges Faced by SMMEs 9
2.6 Cloud Computing Adoption 10
2.7 Theories, frameworks and models underpinning technology adoption 14
2.7.1 Diffusion of Innovation 14
2.7.2 Technology Acceptance Model 16
2.7.3 Technology-Organisation-Environment framework 17
2.7.4 Unified theory of acceptance and use of technology model 19
2.8 Limitations of DOI, TAM, TOE and UTAUT 20
2.9 The integrated framework of DOI, TOE and context-based factors 22
2.10 Contextual factors that influence the adoption of cloud computing by SMMES 24
2.10.1 Availability of IT 24
2.10.2 Government initiatives 25

2.10.3 Socioeconomic challenges 26
2.10.4 Political challenges 26
2.11 The conceptual framework 27
2.12 Summary of the chapter 28

3. RESEARCH METHODOLOGY 29

3.1 Introduction 29
3.2 Research approach 29
3.3 Research design 30
3.4 Setting 30
3.5 Sampling 31
3.5.1 Population 31
3.5.2 Sample 31
3.5.3 Sampling Method 32
3.6 Research instrument 32
3.7 Data collection 34
3.7.1 Administration of questionnaires 34
3.7.2 Data Collection Process 35
3.8 Validity and Reliability 35
3.8.1 Validity 35
3.8.2 Reliability 36
3.9 Data analysis 37
3.9.1 Data Preparation 37
3.9.2 Descriptive Statistics 37
3.9.3 Inferential Statistics 38
3.9.4 Data Interpretation 38
3.9.5 Software and Tools 39
3.10 Ethical considerations 39
3.11 Summary of the chapter 39

4. PRESENTATION OF RESULTS 41

4.1 Introduction 41
4.2 Data screening 41
4.3 Demographic profile of respondents 42
4.3.1 Location distribution 42
4.3.2 Age distribution 43
4.3.3 Business size 43
4.3.4 Cloud computing usage 44
4.3.5 Other demographic characteristics 45
4.4 Checking for Normality 46

4.5 Validity Analysis 47
4.5.1 Exploratory Factor Analysis (EFA) 47
4.5.2 Confirmatory Factor Analysis (CFA) 52
4.6 Reliability Analysis 54
4.6.1 Overall reliability of scales 54
4.6.2 Specific Analysis of the CA Scale 54
4.7 Hypothesis testing 56
4.7.1 Descriptive statistics 56
4.7.2 Multilinear regression analysis 57
4.7.3 Hypothesis testing results 58
4.8 Summary of the chapter 59

5. DISCUSSION OF RESULTS 61

5.1 Introduction 61
5.2 Key findings 61
5.3 Discussion of key findings 61
5.3.1 Discussion of Hypothesis H1a: Availability of IT infrastructure (II) positively influences the adoption of cloud computing (CA) 61
5.3.2 Discussion of Hypothesis H1b: Stable electricity supply (EL) positively influence the adoption of cloud computing (CA) 62
5.3.3 Discussion of Hypothesis H1c: Government initiatives (GI) positively influence the adoption of cloud computing (CA) 62
5.3.4 Discussion of Hypothesis H1d: Socioeconomic challenges (SE) negatively influence the adoption of cloud computing (CA) 62
5.3.5 Discussion of Hypothesis H1e: Political challenges (PO) negatively influence the adoption of cloud computing (CA) 63
5.4 Summary of the chapter 63

6. CONCLUSION 64

6.1 Overview of the Research 64
6.2 Summary of Key Findings 64
6.2.1 IT Infrastructure 64
6.2.2 Stable Electricity Supply 64
6.2.3 Government Initiatives 65
6.2.4 Socioeconomic Challenges 65
6.2.5 Political Challenges 65
6.3 Addressing the Research Question 65
6.4 Implications 66
6.4.1 Theoretical Implications 66
6.4.2 Practical Implications 66
6.4.3 Policy Implications 66
6.5 Limitations of the study 66

6.6 Recommendations for future research 68
6.7 Conclusion 69

7. ACKNOWLEDGEMENTS 70

7.1 Competing interests 70
7.2 Author contributions 70
7.3 Funding information 70
7.4 Data availability 70
7.5 Disclaimer 70

REFERENCES 71

APPENDIX A: Research Instrument 80

APPENDIX B: Participant Information Sheet 86

APPENDIX C: Participant Consent Sheet 88

LIST OF TABLES

TABLE 1: SMME categories 7

TABLE 2: Other demographic characteristics 45

TABLE 3: Descriptive statistics 46

TABLE 4: KMO and Bartlett's test results 47

TABLE 5: Rotation component matrix 48

TABLE 6: Total variance explained 51

TABLE 7: Model fit indices 52

TABLE 8: Cronbach's alpha values for scales 54

TABLE 9: Reliability statistics for CA 55

TABLE 10: Reliability analysis 55

TABLE 11: Descriptive statistics 57

TABLE 12: Regression analysis summary 57

TABLE 13: Hypothesis testing results 59

LIST OF FIGURES

FIGURE 1: Traditional on-premises versus cloud-based service models.....8

FIGURE 2: Diffusion of Innovation 15

FIGURE 3: Technology Acceptance Model 3 17

FIGURE 4: Technology-Organisation-Environment framework 18

FIGURE 5: The UTAUT Model 20

FIGURE 6: The integrated framework of DOI, TOE and context-based factors 23

FIGURE 7: The research conceptual framework 27

FIGURE 8: Location distribution 42

FIGURE 9: SMME age distribution 43

FIGURE 10: Distribution by business size 44

FIGURE 11: Cloud usage 44

FIGURE 12: Scree plot 50

LIST OF ACRONYMS

BNG	Breaking New Ground
CFA	Confirmatory Factor Analysis
DOI	Diffusion of Innovation
EFA	Exploratory Factor Analysis
ERP	Enterprise Resource Planning
GDP	Gross Domestic Product
IaaS	Infrastructure as a Service
IT	Information Technology
MSME	Micro, Small and Medium Enterprise
NIST	National Institute of Standards and Technology
NSB	National Small Business
OECD	Organization for Economic Cooperation and Development
PaaS	Platform as a Service
RDP	Reconstruction and Development Programme
SaaS	Software as a Service
SME	Small and Medium Enterprise
SMME	Small Medium and Micro Enterprise
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
TCE	Transaction Cost Economics
TOE	Technical-Organisation-Environment
TR	Technology Readiness
TREP	Township and Rural Entrepreneurship Programme
TTF	Task-technology Fit
UTAUT	Unified Theory of Acceptance and Use of Technology

1. INTRODUCTION

1.1 Context of the study

Gauteng is a province in South Africa with metropolitan cities such as the City of Johannesburg, the City of Tshwane, and the City of Ekurhuleni (McKenna, 2023). It is renowned for its dynamic culture, heterogeneous people, and flourishing corporate industry (Rogerson, 2001). The region also contains townships, which were established by the apartheid regime to segregate people of colour and isolate them from economic prospects (Rogerson, 2019). As a result, township economies emerged (Mathibe et al., 2021).

Recently, there has been a change in perspective towards acknowledging the potential of SMMEs that operate in township economies. As a result, there have been initiatives to provide assistance and promote their growth. This includes endeavours to foster entrepreneurship and the development of small businesses, enhance infrastructure and financial accessibility, and expand educational and training opportunities. The Gauteng government has initiated many programmes to bolster township economies. The Township and Rural Entrepreneurship Programme (TREP), initiated by the Department of Small Business Development (DSBD), was introduced during the onset of the COVID-19 epidemic to offer financial assistance and guidance to small enterprises (Modiba & Mago, 2022).

Although there have been efforts to acknowledge the potential of SMMEs in township economies to stimulate growth and development in Gauteng province, these economies still encounter notable obstacles. These challenges include elevated levels of poverty and unemployment, insufficient infrastructure, and restricted availability of financial resources and market access (Wiid & Cant, 2021; Kubone, 2018). There are concerns about the high rate of failure and the inability to gain a competitive advantage in their respective industries (Lerato, 2023). To surmount these obstacles, information technologists have started to use modern technologies that can offer a competitive edge and enhance firm

expansion. Information technology (IT) can enhance service delivery efficiency and offer numerous advantages to organisations (Adejuwon, 2018). Conversely, the expenses and duration associated with IT-enabled services are consistently increasing. Cloud computing has emerged as a viable alternative platform due to this, providing several advantages like cost savings, flexibility, scalability, and access to modern technologies that may otherwise be unaffordable for SMMEs (Chakraborty et al., 2023).

1.2 Problem statement

SMMEs in Gauteng townships play a critical role in the local economy, contributing to job creation, innovation, and economic growth (Manyaka-Boshielo, 2017). However, these businesses often face significant challenges in adopting new technologies, such as cloud computing, which are essential for improving operational efficiency, competitiveness, and scalability (Ali et al., 2021; Amron et al., 2019). Some of the benefits include the ability to easily adjust the size and capacity, elasticity, measurable services, improved compatibility with other systems, and cost reduction (Malallah et al., 2023; Vinoth et al., 2022)

While cloud computing may seem like an obvious solution that SMMEs should consider to alleviate some of their challenges, its rate of adoption among these businesses is relatively low (Lerato, 2023; Mudzamba et al., 2022; Shetty & Panda, 2021). The reluctance to adopt cloud computing may stem from various barriers. These barriers not only hinder the growth and sustainability of SMMEs but also limit their ability to compete in an increasingly digital economy.

This research seeks to address the gap in understanding the extent to which specific contextual factors influence cloud computing adoption among SMMEs in Gauteng townships.

1.3 Aim and objectives

The primary aim of this study was to investigate the extent to which specific contextual factors influence the adoption of cloud computing technology in SMMEs located in the townships of Gauteng, South Africa. This research sought

to analyse the factors that facilitate or hinder the uptake of cloud computing in these enterprises, providing insights that can inform policy and strategic decisions to enhance technological adoption and business performance. The objective was broken down into the following sub-objectives:

1. Investigate the extent to which the availability of IT infrastructure influences the adoption of cloud computing technology in SMMEs located in the townships of Gauteng.
2. Investigate the extent to which stable electricity supply influences the adoption of cloud computing technology in SMMEs located in the townships of Gauteng.
3. Investigate the extent to which government initiatives influence the adoption of cloud computing technology in SMMEs located in the townships of Gauteng.
4. Investigate the extent to which socioeconomic challenges influence the adoption of cloud computing technology in SMMEs located in the townships of Gauteng.
5. Investigate the extent to which the political environment influences the adoption of cloud computing technology in SMMEs located in the townships of Gauteng.

1.4 Significance of the study

The adoption of cloud computing by SMMEs has been widely recognised as a critical factor in enhancing business efficiency, competitiveness, and scalability in the digital age (Ali et al., 2021; Amron et al., 2019). Previous research has extensively explored the benefits of cloud computing, highlighting its potential to reduce operational costs, increase flexibility, and improve data accessibility (Malallah et al., 2023; Vinoth et al., 2022). However, while these benefits are well-documented, the adoption rates of cloud computing among SMMEs, particularly in developing regions such as Gauteng townships, remain low (Lerato, 2023; Mudzamba et al., 2022; Shetty and Panda, 2021). Studies have identified barriers

such as limited technological awareness, high costs, and security concerns as significant impediments (Khayer et al., 2021; Modisane & Jokonya, 2021; Mudzamba et al., 2022b).

Several studies have offered valuable insights into the factors that affect the adoption of cloud computing technologies by small, medium, and micro enterprises (SMMEs). For instance, Tongsuksai et al. (2023) discovered that the adoption of cloud ERP systems is influenced by factors such as system dependability and data security. Zhang et al. (2021) surveyed 123 Chinese enterprises and discovered nine specific combinations of factors that strongly influence the adoption of cloud computing. According to Guo et al. (2023), implementing internal IT modularity with the goal of organisation-wide, top-down strategic business transformation can assist enterprises of any size in effectively adopting application-level cloud services. The research conducted by Skafi et al. (2020) in Lebanon determines that the preparedness of SMEs in terms of technology and organisation is important for adopting cloud computing. However, the adoption is also highly influenced by environmental and contextual factors, such as regulatory conditions and cultural attitudes. Within the South African context, Mudzamba et al. (2022b) conducted a study that highlights the primary obstacles to cloud adoption, which include apprehensions regarding data security, a shortage of qualified staff, and the significant expenses linked to deployment. The study also emphasises that although SMMEs acknowledge the potential advantages of cloud computing, these obstacles greatly impede its widespread adoption in the South African setting. Another study conducted by Bvuma and Marnewick (2020a) reveals that SMMEs in South African townships face unique barriers to ICT adoption, including limited infrastructure, high costs, and lack of technical skills.

Despite these valuable insights, there is a notable gap in the literature regarding the specific contextual factors that influence cloud computing adoption among SMMEs in township settings. Existing studies often focus on broader regional or national contexts, neglecting the unique socio-economic and infrastructural challenges faced by businesses in township environments. This research aims to

fill this gap by taking a localised approach, focusing specifically on the barriers and drivers of cloud computing adoption within Gauteng townships.

This study contributes to the existing conversation by adopting a comprehensive approach that considers not only the technological and financial factors but also the socioeconomic and environmental factors that are particularly relevant to township SMMEs. By doing so, it provides a nuanced understanding of the challenges and opportunities associated with cloud computing adoption in this specific context, which has been underrepresented in previous research.

The research fills the gap through an empirical approach, gathering data directly from SMMEs in Gauteng townships to analyse their experiences and perspectives. This empirical focus is complemented by a theoretical contribution, as the study seeks to expand existing models of technology adoption to better account for the unique circumstances of township businesses.

The findings of this study will benefit a range of stakeholders. Policymakers will gain insights into the specific needs and challenges of township SMMEs, enabling them to design targeted interventions and support programs. Technology providers will benefit from a better understanding of the barriers to adoption, allowing them to tailor their products and services to meet the needs of township businesses. Finally, the SMMEs themselves stand to benefit from the study's recommendations, which will be aimed at overcoming the identified barriers and enhancing their capacity to leverage cloud computing for growth and development.

By addressing the specific needs of township SMMEs, this research not only fills a critical gap in the literature but also has the potential to drive meaningful change in the digital transformation of small businesses in under-resourced areas.

2. LITERATURE REVIEW

2.1 Introduction

A systematic literature review was conducted to investigate the extent to which contextual factors influence the adoption of cloud computing technologies by SMMEs operating in the township economies of Gauteng Province in South Africa. The literature review focused on three main objectives: firstly, conducting an empirical review to establish the empirical evidence published in the literature about the study's issue. The second review, a theoretical analysis, aimed to establish the theoretical basis for the empirical findings documented in the literature. Furthermore, the literature review established a conceptual framework based on the theoretical foundation for this study.

2.2 Small Medium and Micro Enterprises (SMMEs)

There is a lack of consensus over the specific attributes that identify SMMEs. Various geographical areas use distinct terminology to describe small businesses (Bvuma & Marnewick, 2020b). SMMEs in South Africa are classified based on the industry or surroundings in which they function. The NSB Act of 1996 categorises SMMEs as distinct entities that can operate in any sector or sub-sector of the economy. The NSB Amendment Acts of 2003 and 2004 introduced an extra definition (Abedian et al., 2001). The NSB Amendment Acts of 2003 and 2004 introduced a supplementary definition of an SMME. According to this definition, an SMME must be a separate business entity that is overseen by one or more individuals and must also meet specific criteria (Bvuma & Marnewick, 2020b). TABLE 1 presents the classification of SMMEs as outlined in the National Small Business Act of South Africa.

TABLE 1: SMME categories

Enterprise Size	Number of Employees	Annual Turnover in South African Rand	Gross Assets (Excluding Fixed Property)
Medium	Fewer than 100 to 200, depending on the industry	Less than R4 million to R50 m, depending on the industry	Less than R2 m to R18 m, depending on the industry
Small	Fewer than 50	Less than R2m to R25 m, depending on the industry	Less than R2m to R4.5 m, depending on the industry
Very Small	Fewer than 10 to 20, depending on the industry	Less than R200,000 to R500,000, depending on industry	Less than R150,000 to R500,000, depending on industry
Micro	Fewer than 5	Less than R150,000	Less than R100,000

Source : Bvuma and Marnewick (2020b)

This study embraces the revised definition put forth by the South African government in 2019. The initial definition of SMMEs incorporated a third indicator (total gross asset value), however, the revised definition now exclusively relies on two indicators (number of employees and yearly turnover) (*National Small Business Act, No 102 of 1996.*, 1996). As to the study's definition, an SMME refers to any institution or organisation, including individuals, involved in small business operations across several industries, irrespective of their legal or tax registration status.

2.3 Cloud Computing

Cloud computing, while not new, has evolved significantly from its origins in grid computing, which addressed parallel computing challenges (Modisane & Jokonya, 2021). The concept dates back to the 1960s when Professor John McCarthy at Stanford University introduced the computer time-sharing theory, foreseeing computing as a public utility (Sithole and Ruhode, 2021; Garfinkel, 2011). The early 2000s saw the introduction of Software-as-a-Service (SaaS), marking a pivotal advancement in cloud computing, enabling users to subscribe to web services (Oliveira et al., 2014; Gustafson & Orrgren, 2012).

The National Institute of Standards and Technology (NIST) defines cloud computing through six key characteristics: on-demand self-service, multi-tenancy and resource pooling, rapid elasticity, ubiquitous access, measurable service,

and resilience. On-demand self-service allows users to access server time and storage independently. Multi-tenancy and resource pooling facilitate quick scaling to meet demand. NIST also categorises cloud computing into three main service models: Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS), each offering cost-effective alternatives to traditional IT deployments (Mell & Grance, 2011; Sithole & Ruhode, 2021). FIGURE 1 shows the main differences in service models, including the various responsibility splits between the client and service provider for each option (Dufrasne et al., 2015).

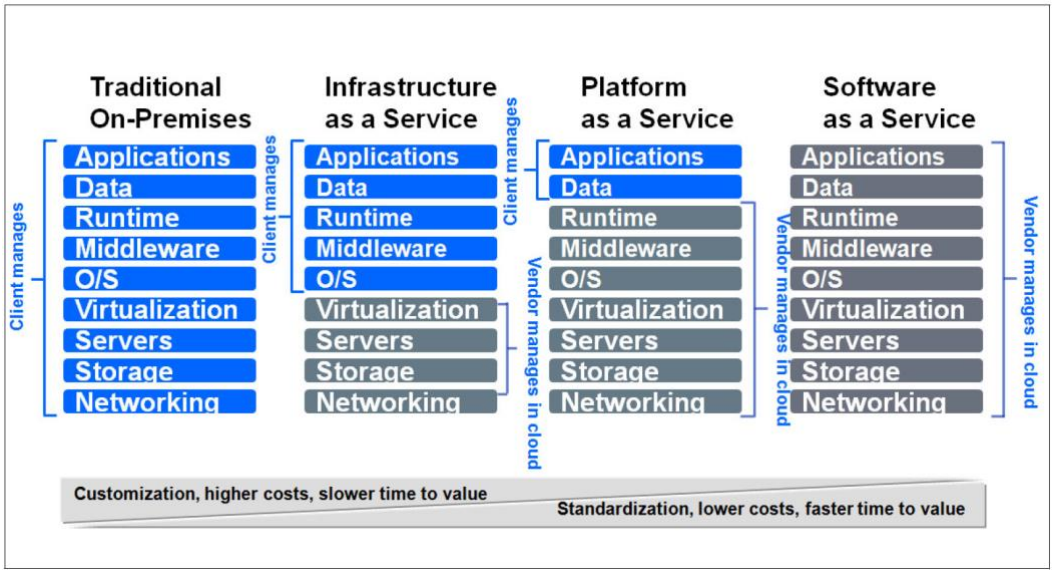


FIGURE 1: Traditional on-premises versus cloud-based service models

Furthermore, the cloud-based services can be configured using four different primary cloud deployment models: public, private, community, and hybrid clouds (Mell & Grance, 2011). Public clouds are accessible to multiple customers and typically offer services like SaaS, PaaS, or IaaS (Mell & Grance, 2011). Private clouds serve a single organisation, either managed by a service provider or the organisation itself (Mell & Grance, 2011). Community clouds cater to organisations with similar objectives, such as banking institutions, and are either self-managed or maintained by a service provider (Mell & Grance, 2011). Hybrid clouds combine multiple deployment models, allowing organisations to use private clouds for sensitive data and public clouds for less critical information (Ambrose & Dagland, 2010).

2.4 Benefits of Cloud Computing

Enterprises must employ state-of-the-art technology that provides them with a competitive edge to adjust to the constantly evolving business landscape. Previous studies have shown that cloud computing has the potential to help SMMEs address their organisational, technological, and environmental challenges (Sengkhyavong, 2019). Cloud computing allows SMMEs to efficiently handle and retain their data (Stieninger et al., 2018). This technology offers the advantage of allowing smaller firms to store large volumes of data off-site, which can be beneficial if they are unable to accommodate all the data on their servers (Effiong,2020).

Cloud computing enables enterprises to optimise cost management, enhance customer service, enhance data security and retrieval, streamline service delivery and management, leverage on-demand provisioning and pay-per-use business models, and reduce production times (Widyastuti & Irwansyah, 2018; Matias & Hernandez, 2021; Sithole & Ruhode, 2021). SMMEs have the potential to become significant participants not just in their local markets but also on a global scale by capitalising on the advantages available to them and implementing operational modifications (Effiong, 2020).

2.5 Cloud Computing Challenges Faced by SMMEs

SMMEs face several challenges when adopting cloud computing. One major hurdle is the initial cost and complexity of transitioning from traditional IT infrastructure to cloud-based solutions (Doherty et al., 2015; Park & Kim, 2014). Many SMMEs have limited budgets and may struggle to afford the necessary technology upgrades and training (Doherty et al., 2015). Additionally, there is often a lack of technical expertise within these organisations, making it difficult to effectively implement and manage cloud services (Ali Al-Nassar, Nawaf Al-Nsour & Ali Rababah, 2021). Security concerns also pose a significant challenge, as smaller enterprises may not have robust cybersecurity measures in place to protect sensitive data in the cloud (Alismaili et al., 2020; Avram, 2014 & Skafi et

al., 2020). Furthermore, issues related to data privacy and compliance with regulations can complicate the adoption process (Conz, Denicolai & Zucchella, 2017). Finally, SMMEs might experience resistance to change from employees accustomed to existing systems, making the transition to cloud computing slower and more challenging cloud (Alismaili et al., 2020). Although SMMEs encounter difficulties in implementing cloud computing, numerous researchers (such as Alsafi and Fan, 2020; Assante et al., 2016; Conz et al., 2017; Gupta et al., 2013) argue that SMMEs that do not embrace cloud computing are at a lower probability of achieving success compared to those that do.

2.6 Cloud Computing Adoption

The adoption and utilisation of cloud computing differ among economic sectors and countries (Saratchandra & Shrestha, 2022). This section provides a comprehensive assessment of prior research on the adoption of cloud computing. The aim is to identify different models and theories that have emphasised the factors influencing enterprises' decisions to adopt new technology.

Munguti and Opiyo (2018) conducted a study on Kenyan software development organisations in order to identify the elements that influence the adoption of cloud computing. The TOE framework was utilised to employ a mixed research technique to conduct a survey and interview a total of two hundred and eighty-three (283) firms. The study revealed that the adoption of cloud computing in organisations was influenced by organisational, environmental, and technological factors. The study found that the adoption of cloud computing across the entire organisation was impeded by policy, organisational, technological, and legal issues.

Singh and Mansotra (2019) employed the TOE framework to examine the determinants of cloud computing uptake in Indian educational institutions. A total of fifty-six (56) secondary schools were surveyed and contributed to the primary data. The study determined that the adoption of cloud computing was influenced by technological, environmental, and organisational variables. Furthermore, there is a strong correlation between technological and environmental factors, which

significantly impact the adoption of cloud computing in school education departments. The adoption of cloud computing is primarily influenced by technology and environmental variables, with technological factors (such as relative advantage, compatibility, and complexity) having the greatest impact. The survey also identified that good top management assistance is essential.

Alismaili *et al.* (2020) conducted a study to investigate the impact of technological, risk, and environmental factors on the adoption of cloud computing in Australia. Data was acquired directly from two hundred and three (203) SMMEs. The TOE framework was adapted to represent the research. The study discovered that three contextual variables, namely technological, risk, and environmental factors, had an impact on the adoption of cloud computing. In contrast to previous research, organisational characteristics were found to have no impact on the adoption of cloud computing.

Modisane and Jokonya (2021) employed the TOE framework to examine the adoption of cloud computing in small, medium, and micro enterprises. The study involved surveying one hundred and eleven (111) SMMEs in the Ngaka Modiri Molema and Bojanala Platinum Districts of the North West Province in South Africa. The findings indicate that the adoption of cloud computing is influenced by technological, organisational, and environmental factors. Further analysis of the organisational context revealed that it had a detrimental impact on the adoption of cloud computing practices, but the impact was not considerable. Ultimately, an analysis of the environmental factors revealed that these characteristics had a beneficial and statistically noteworthy influence on the adoption of cloud computing methods by SMMEs.

Sithole and Ruhode (2021) investigated the potential advantages and obstacles associated with the use of cloud computing by SMMEs in South Africa. The study was facilitated using the TOE framework. A survey obtained primary data from a total of one hundred and seventy (170) SMMEs. The study identified several factors that influence the use of cloud computing by SMMEs, including relative advantage, company scope, technology readiness, competitive pressure, and

government backing. Complexity presented both advantageous possibilities and difficulties, but it did not serve as an obstacle.

Matias and Hernandez (2021) conducted a study to examine the determinants of cloud adoption intention among micro, small, and medium enterprises (MSMEs) in the Philippines. The study involved surveying and interviewing thirty (30) MSMEs to get primary data from them. The study revealed that the primary factors driving the adoption of cloud computing among MSMEs in the Philippines are regulatory support and competitive pressure. The study also found that the perceived advantages, IT capacity, and business concerns of utilising cloud computing do not affect the adoption of cloud computing in organisations.

Alshirah *et al.* (2021) investigated the impact of mimetic, coercive, and normative pressure on the intention to use a Cloud Based Accounting Information System. A total of one hundred and forty-two (142) manufacturing SMEs in Jordan were surveyed. Various contextual influences, including mimetic pressure, coercive pressure, and normative pressure, were found to have a beneficial impact on the intention to adopt a Cloud Based Accounting Information System.

In a study conducted by Sengkhyavong (2019), a non-experimental correlational approach was used to investigate the association between the adoption of cloud computing by IT managers at small and medium-sized enterprises in the United States and their perceptions of usefulness, ease of use, security, reliability, and benefits. A total of ninety (90) respondents were questioned to collect primary data. The study determined that the adoption of cloud computing was influenced by the perceived usefulness, ease of use, and benefits. The study also discovered that the perceived security and reliability had no impact on the adoption of cloud computing.

Sayginer and Ercan (2021) examined the factors influencing the adoption of cloud computing by Turkish organisations. A survey was conducted on one hundred and twenty (120) enterprises using the Diffusion of Innovation theory. The study revealed that the adoption of cloud computing is influenced by factors such as perceived advantage, affordability, agility, robustness, and compatibility.

Oladele, Haroon-Sulyman and Afolayan (2021) investigated the use of cloud computing by SMEs. The study analysed the adoption of cloud computing about performance and technological variables. The study surveyed two hundred and forty-nine (249) SMEs in Ilorin, Kwara State, Nigeria. According to the survey, the findings indicate that technology and performance play a crucial role in the adoption of cloud computing by SMEs.

Alipour *et al.* (2021) investigated the adoption of cloud computing by public hospitals connected with Zahedan University of Medical Sciences. The study incorporated the desire to integrate cloud computing into the TOE framework. This model surveyed seven hundred (700) individuals. The study reveals that the primary factors influencing the adoption of cloud computing, as seen by consumers, are the environmental, human, organisational, and technological aspects. The primary elements that had the biggest impact on the acceptance of cloud computing were determined to be the advantages of adopting cloud computing, the relative advantage it provided, and the competitive pressure to adopt it.

Kumar, Naveen and Savitha (2022) conducted a study to assess the effects of business variables, economic performance, and environmental performance difficulties on SMEs when adopting cloud computing. The study utilised the Technology Acceptance Model (TAM), Technological Organisational Environmental (TOE) Framework, and Transaction Cost Economics (TCE) to develop a model that was employed to survey four hundred and ten (410) SMEs in Karnataka. The study revealed a strong correlation between technological, organisational, environmental, and economic performance aspects, highlighting their significance in the adoption of cloud computing.

Skafi, Yunis and Zekri (2020) conducted a study to investigate the factors linked to the adoption of cloud computing among SMEs in the Lebanese market. The study utilised the TOE framework and Contextual Factor theory to investigate the influence of technological, organisational, environmental, and country-specific factors on the adoption and implementation of cloud computing technologies. The study employed quantitative analysis to survey a total of one hundred and thirty-

nine (139) SMEs. The study revealed that the adoption of cloud computing is influenced by various factors, including complexity, security, top management support, prior IT experience, country-specific or contextual factors, user-friendliness, data security, privacy, relative advantage, cost-effectiveness, compatibility, trialability, top management, technology experience, and supplier or competitive computing power.

2.7 Theories, frameworks and models underpinning technology adoption

Several theories have been developed previously to investigate the factors that influence businesses' decisions to adopt new technologies. These include the diffusion of innovation (DOI), the Technology-Organisation-Environment (TOE) framework, the Technology Acceptance Model (TAM), and the Unified Theory of Acceptance and Use Technology (UTAUT). The aforementioned theories and frameworks have been chosen for review to establish an appropriate theoretical framework for this empirical study.

2.7.1 *Diffusion of Innovation*

DOI (depicted in FIGURE 2) is a theoretical framework that explains the process, reasons, and speed at which new ideas and technology are adopted and disseminated within different cultures. It focuses on the behaviour of individuals and firms in this process. The DOI theory posits that innovations are disseminated through certain channels over some time and within a specific social system (Rogers, 2003). People are perceived to have varying levels of openness to embrace new ideas, and as a result, it is commonly observed that the rate at which a population adopts an invention follows a normal distribution over time (Rogers, 2003). The normal distribution can be divided into parts, resulting in the categorisation of persons into five distinct groups of individual innovativeness, ranging from the earliest adopters to the latest adopters: innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). According to Rogers (2003), the process of innovation in organisations is far more intricate.

Typically, it entails the participation of multiple persons, potentially consisting of both proponents and detractors of the novel concept, each of whom contributes to the process of adopting the innovation (Rogers, 2003).

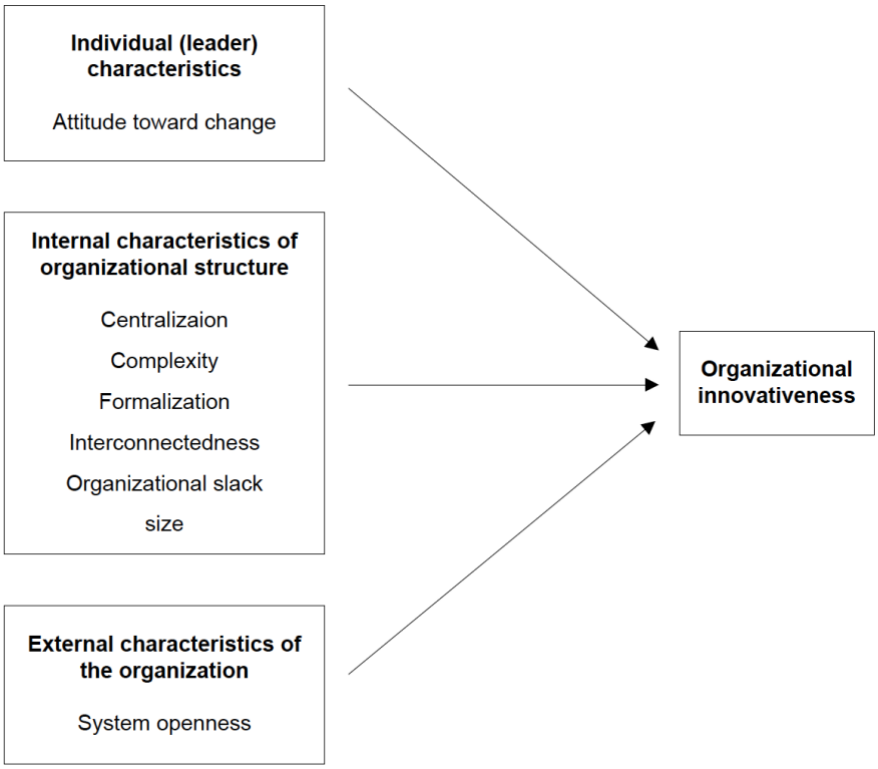


FIGURE 2: Diffusion of Innovation

According to DOI theory at the business level, innovativeness is associated with independent variables such as individual (leader) characteristics, internal organisational structure characteristics, and external characteristics of the organisation. Individual characteristics refer to the leader's disposition towards change(Rogers, 2003). Internal characteristics of organisational structure can be observed through various factors. These factors include centralisation, which refers to the concentration of power and control in the hands of a few individuals within the system (Rogers, 2003). Complexity refers to the level of knowledge and expertise possessed by the members of the organisation (Rogers, 2003). Formalisation is the extent to which an organisation emphasises adherence to rules and procedures (Rogers, 2003). Interconnectedness measures the degree to which units within a social system are linked through interpersonal networks

(Rogers, 2003). Organisational slack refers to the availability of uncommitted resources within an organisation(Rogers, 2003). Lastly, size is simply the number of employees in the organisation (Rogers, 2003). The external characteristics of an organisation refer to the degree of openness in its system (Rogers, 2003).

2.7.2 *Technology Acceptance Model*

Davis (1989) introduced the Technology Acceptance Model as a means to forecast the extent to which users will embrace information technology. According to TAM, an individual's inclination to adopt technology is impacted by two beliefs: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989). PU is defined as the individual's belief that using a technology will have a beneficial effect on their performance, whereas PEOU refers to the user's perception that using a specific system will require minimal effort (Davis, 1989).

TAM posits that an individual's behavioural intentions to utilise technology are influenced by their attitude towards the technology. The initial TAM model provided limited information regarding a user's perspective on the implementation of specific systems, as it focused solely on PU and PEOU (Shoniwa, 2021). While the extensive use of TAM demonstrated the strength of the theory (as it explained approximately 40% of the variation in technology acceptance on average), the creators of the model sought to enhance its ability to make accurate predictions (Marikyan & Papagiannidis, 2023). As such, TAM2 was expanded by incorporating five further exogenous variables and two moderators, as stated by Marikyan and Papagiannidis (2023). The additional constructs and moderators incorporated in TAM2 were: subjective norm, image, job relevance, output quality, result demonstrability, experience and voluntariness. Due to criticism that TAM did not offer sufficient practical guidance to professionals (Lee, Kozar & Larsen, 2003), Venkatesh and Bala (2008) integrated the factors of perceived usefulness and perceived ease of use into a single model and renamed the model TAM3. They examined the relationship between these factors and perception variables to eliminate any overlapping effects (Marikyan & Papagiannidis, 2023). They did this to offer a systematic framework that explains the adoption of

technology in a thorough manner (Marikyan & Papagiannidis, 2023). FIGURE 3 provides a pictorial view of the TAM3 model (Venkatesh & Bala, 2008).

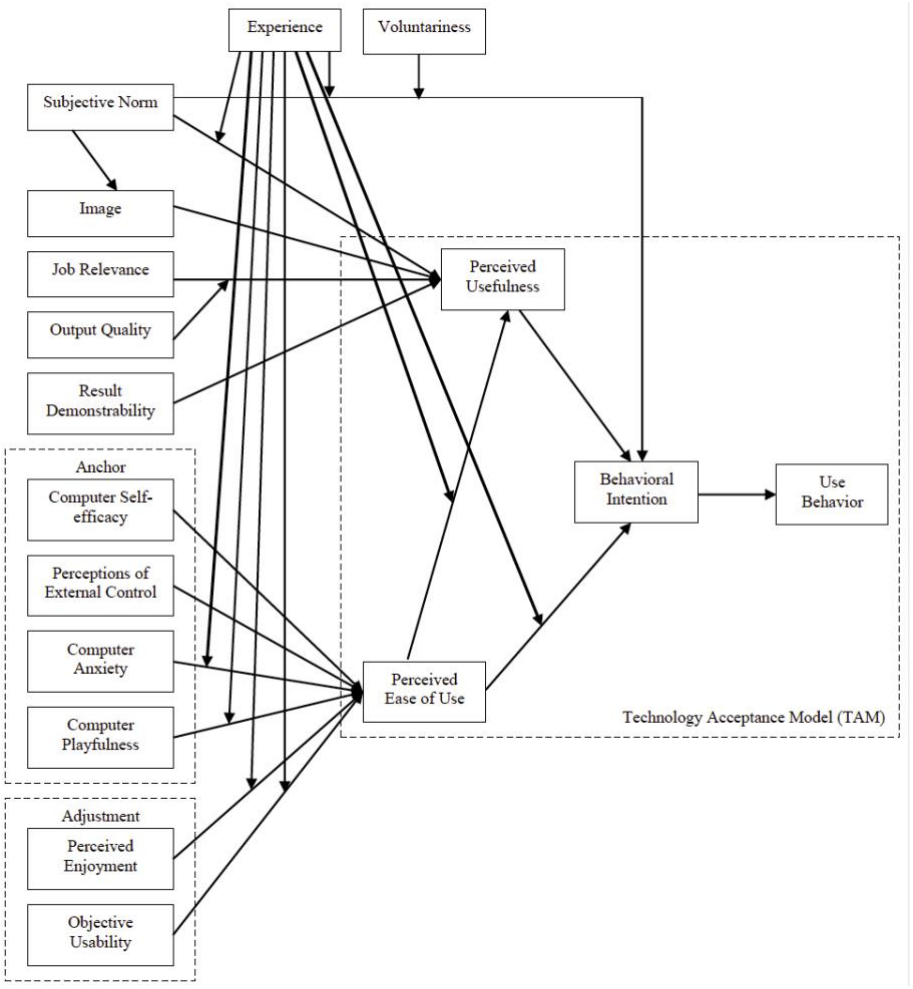


FIGURE 3: Technology Acceptance Model 3

2.7.3 *Technology-Organisation-Environment framework*

The TOE framework, initially created by Tornatzky and Fleischer (1990) asserts that the adoption of technology is influenced by three factors: technology development, organisational conditions, and industry environment. FIGURE 4 illustrates the TOE framework (Tornatzky et al., 1990).

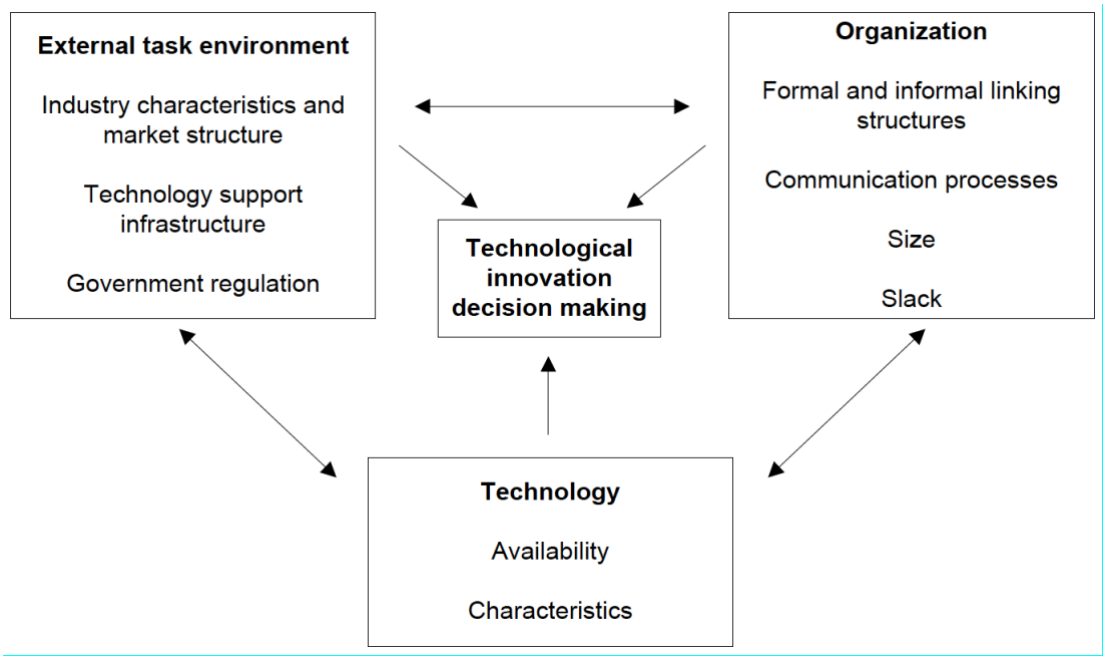


FIGURE 4: Technology-Organisation-Environment framework

The TOE framework provides a useful analytical tool for studying the implementation of different types of Information Technology innovation (Munguti & Opiyo, 2018). The TOE framework is considered to be an inclusive framework that provides a theoretical foundation for research on the adoption of ICT. This research typically examines different technological, organisational, and environmental factors that either facilitate or hinder adoption (Sayginer & Ercan, 2021).

The technological context indicates that the adoption of a technology depends on the available technologies within and outside the company, as well as the perceived benefits of using the technology, compatibility with existing systems and processes, the complexity of learning and using the technology, the ability to test it through a pilot program, and the visibility of its results (Tornatzky & Fleischer, 1990). The expenses associated with hardware and software, as well as the expenses related to ensuring that they work properly with the current ICT infrastructure, are considered part of the technological context (Sayginer & Ercan, 2021).

The organisational context encompasses factors such as the company's size, the calibre of its human resources, and the intricacy of its management structure (Tornatzky & Fleischer, 1990). Establishing a culture of technology adoption inside an organisation requires strong backing from senior management (Ahmed, 2020). Senior executives can enhance significant organisational changes through various means (Ahmed, 2020). For example, by effectively conveying the organisation's values, strategy, and the role of technology in executing this strategy by verbal or written means; and highlighting the significance of innovation internal and external to the company (Ahmed, 2020).

The environmental context is defined as the external stakeholders of a firm that can impact the organisation's perception of innovation in their business operations and establish a strategy to obtain the necessary resources for innovation (Tornatzky & Fleischer, 1990). These stakeholders may either support or oppose technological innovation (Tornatzky & Fleischer, 1990).

2.7.4 *Unified theory of acceptance and use of technology model*

The Unified Theory of Acceptance and Use of Technology Model is a model established by Venkatesh *et al.* (2003) to explain the acceptance of technology by users (Salam & Ali, 2020). The UTAUT model consists of four main components: performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). These structures have a significant impact on the individual's intention to use a certain technology (Venkatesh et al., 2003).

Performance Expectancy refers to the extent to which individuals believe that using technologies will enhance their performance. Effort Expectancy refers to the extent to which users perceive that using technologies will not be challenging. Social influence refers to the degree to which individuals depend on significant others to influence their adoption of technologies. Facilitating Conditions refers to the degree to which the necessary organisational and technical infrastructure for supporting the technologies is there.

According to Venkatesh *et al.* (2003), the first three constructions (performance expectancy, effort expectancy, and social influence) directly determine Behaviour Intention (BI), while the fourth construct (facilitating conditions) directly determines Use Behaviour (UB), which evaluates an individual's likelihood of using the technology. Venkatesh *et al.* (2003) propose that gender, age, and experience diminish the impact of the four primary factors on Behaviour Intention, as depicted in FIGURE 5 (Venkatesh et al., 2003). They argue that gender, in particular, has a robust and enduring influence on basic psychology.

The UTAUT model aims to understand system utilisation and provide notions that are not reliant on any certain theoretical approach (Venkatesh *et al.*, 2003; Salam & Ali, 2020)

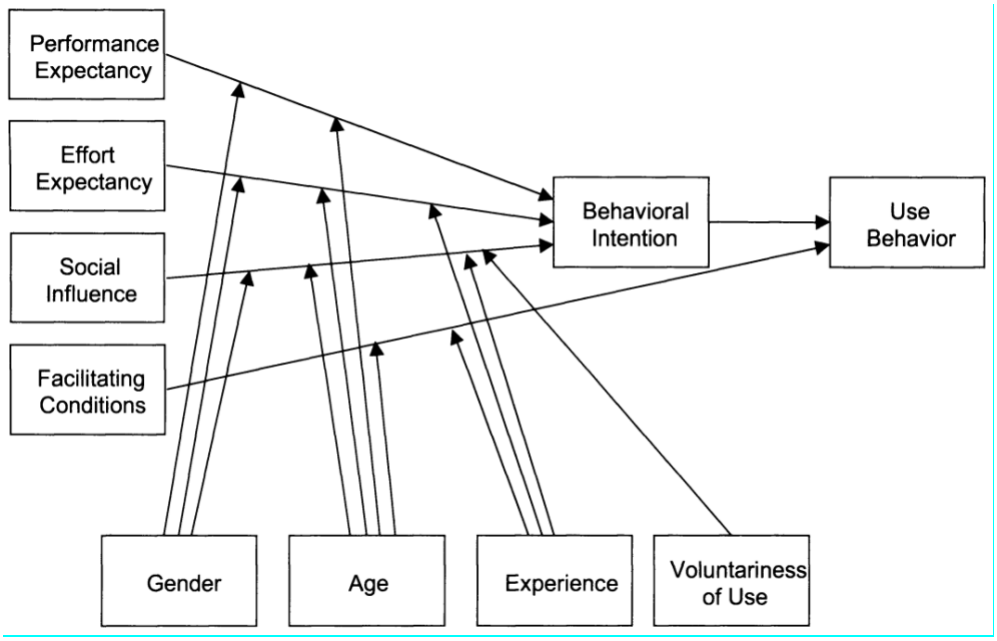


FIGURE 5: The UTAUT Model

2.8 Limitations of DOI, TAM, TOE and UTAUT

The adoption of cloud computing by SMMEs in Gauteng townships, South Africa, is influenced by various contextual factors. While previous models such as the DOI theory, TAM, TOE framework, and UTAUT have provided valuable insights,

they also exhibit certain limitations in the context of cloud computing adoption by SMMEs in Gauteng townships. Some of the limitations are discussed below.

One significant drawback of the DOI theory is its heavy reliance on the perceived attributes of innovation, such as relative advantage, compatibility, complexity, trialability, and observability. These factors, while important, often fail to incorporate the intersecting impacts of various contexts and domains (MacVaugh & Schiavone, 2010). Recently, Iqbal and Zahidie (2022), highlighted that the DOI model tends to overlook the nuanced socio-cultural and economic barriers that are prevalent in under-resourced communities.

A significant critique of the TOE framework is that key characteristics in the adoption predictors are presumed to be more relevant to large organisations, where clients have a higher level of certainty and fewer complaints, than to SMMEs (Chiza, 2018). Also, Skafi, Yunis and Zekri (2020) have pointed out that the TOE framework often underrepresents the socio-economic dimensions and the role of local community support systems, which are vital in township settings.

TAM is critiqued for its lack of specificity regarding how technology utilisation might enhance performance using various variables (Venkatesh et al., 2003). Additionally, it fails to consider an organisation's external elements that influence the acceptance of technology, despite its emphasis on perceived ease of use (Tobergte & Curtis, 2013). Another drawback of TAM is that it is limited to studying a single information system with a specific group of individuals performing a task at a certain time. This raises the issue of generalising the findings of any particular study (Lee, Kozar & Larsen, 2003).

UTAUT has been criticised due to its tendency to assume a level of uniformity in the factors influencing technology adoption, which does not hold in diverse and resource-constrained environments (Salimon et al., 2023). Research by Bvuma and Marnewick (2020a) also indicates that UTAUT often overlooks critical contextual factors such as local economic conditions, cultural attitudes towards technology, and the varying levels of technological literacy among township business owners.

Addressing the gaps created by these limitations is crucial for advancing our understanding and strategic application of cloud computing technologies. By integrating theoretical frameworks that consider both global and local contexts, future research can better inform policies and practices that facilitate more effective cloud computing adoption strategies tailored to diverse economic environments like township SMMEs in Gauteng. This holistic approach promises to enhance the relevance and impact of cloud computing in fostering economic growth and innovation.

2.9 The integrated framework of DOI, TOE and context-based factors

Traditional models like DOI, TOE, TAM and UTAUT frameworks have provided significant insights into technology adoption processes. However, these models often fell short of addressing the unique challenges faced by SMMEs in under-resourced environments (Skafi, Yunis & Zekri, 2020).

To bridge this gap, Skafi, Yunis and Zekri (2020) proposed an integrated framework that combines DOI, and TOE with Contextual Factors Theory to include additional context-based factors. The framework is depicted in FIGURE 6 (Skafi, Yunis & Zekri, 2020). Contextual Factors theory does not refer to a specific theory that can be attributed to a single concept (Coles et al., 2017). It is a broad term used to describe various theories and frameworks that emphasise the importance of contextual factors in shaping the behaviours and development of an individual or group of individuals (Coles et al., 2017). It is based on factors that reflect a particular context, and characteristics unique to a particular group, community, society or individual (Barzilai-Nahon, Gomez & Ambikar, 2009). Different scholars and researchers have contributed to the understanding of contextual factors and their impact on individuals. Some notable contributors include Lewin (1952) who posits through his study that behaviour is influenced by the individual's psychological environment, Coleman (1969) emphasises in his study that a child's family is more important than school resources for their

achievement, and Vygotsky's (1978) sociocultural theory emphasises the importance of social interaction and scaffolding.

This framework aims to provide a more comprehensive understanding of the determinants influencing cloud computing adoption in these specific settings. By incorporating contextual factors such as political issues, initiatives by government, and infrastructural challenges, this integrative approach seeks to address the limitations of previous models and offer a more nuanced perspective on the adoption process (Skafi, Yunis & Zekri, 2020).

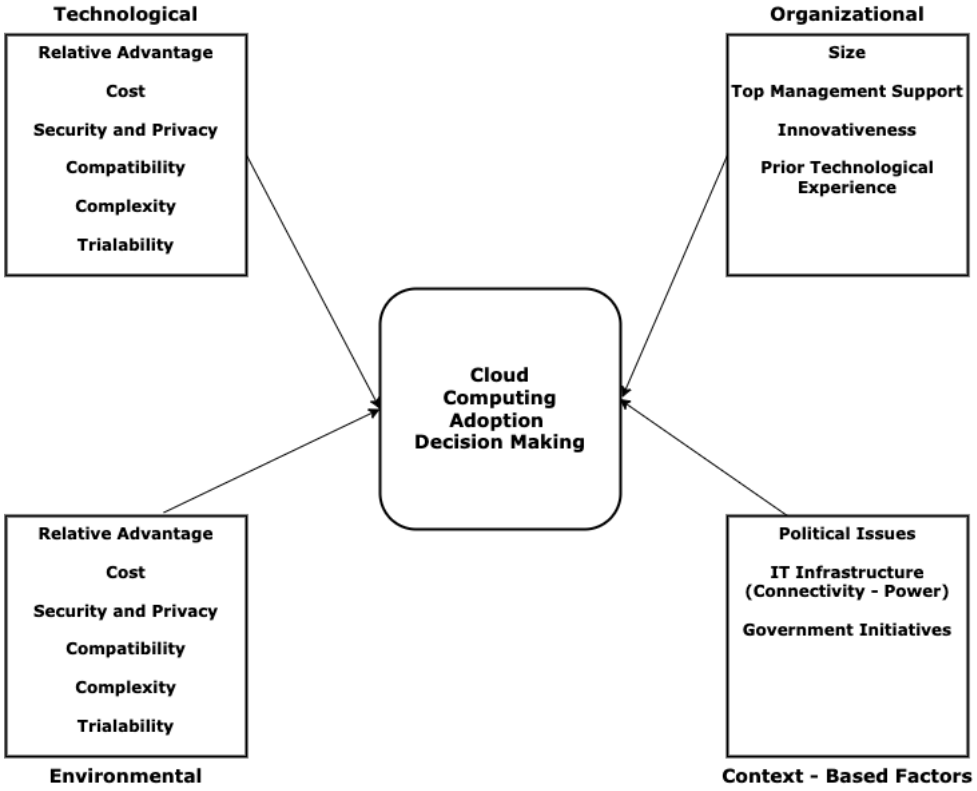


FIGURE 6: The integrated framework of DOI, TOE and context-based factors

Since the technology, organisational, and environmental factors have been discussed in detail when outlining the DOI and TOE models, this section focused on the context-based factors.

According to Skafi, Yunis and Zekri's (2020) framework, the context-based factors construct comprises four independent variables: IT infrastructure,

connectivity - power, government initiatives, and political issues; and one dependent variable: Cloud Computing Adoption as depicted in FIGURE 6.

2.10 Contextual factors that influence the adoption of cloud computing by SMMES

The research investigated the most significant contextual factors that influence the adoption of cloud computing by SMMEs. This analysis ranks political issues, IT infrastructure, connectivity - power, and government initiatives as the most important factors.

Furthermore, The adoption of technology in Africa is considerably influenced by socioeconomic disparities, such as education, income levels, and urban-rural divides (Anlimachie & Avoada, 2020). The digital divide is further exacerbated by the limited availability of quality education and digital skills training, which limits the opportunities for individuals to engage in the digital economy (Udo et al., 2024).

Therefore, based on the current literature, the following hypothesis is formulated about the five (5) variables or factors:

Hypothesis 1 – H1*: Political issues, IT infrastructure, stable electricity supply, government initiatives, and socioeconomic challenges are contextual factors that influence the adoption of cloud computing by SMMEs in Gauteng townships in South Africa.*

2.10.1 *Availability of IT*

Availability of IT Infrastructure refers to the availability and quality of information technology infrastructure, including internet connectivity, hardware, and software (Skafi, Yunis & Zekri, 2020). When it comes to using cloud computing, the availability of IT infrastructure is crucial (Ali *et al.*, 2021; Alasady, Hashim & Awadh, 2023). Employing cloud services is contingent upon having a dependable and fast internet connection, as internet connectivity is essential for utilising these services (Alasady, Hashim & Awadh, 2023). The study by Sadoughi, Ali and Erfannia (2020) acknowledged that the efficacy of technological infrastructures,

such as power and bandwidth, is crucial in facilitating cloud adoption in Turkey. According to another report on the economic impact of cloud computing in developing countries, it is observed that the preparedness and enthusiasm of developing countries, such as Lebanon, to embrace cloud computing technology services are hindered by sluggishness and discouragement (Skafi, Yunis & Zekri, 2020). This is primarily attributed to the prevalence of frequent power outages, inadequate connectivity, substandard infrastructure, and various challenges associated with the economy and politics of these countries (Skafi, Yunis & Zekri, 2020).

This study suggests the following hypotheses:

Hypothesis 1(a) – H1a*: Availability of IT infrastructure (II) positively influence the adoption of cloud computing (CA)*

Hypothesis 1(b) – H1b*: Stable electricity supply (EL) positively influence the adoption of cloud computing (CA)*

2.10.2 *Government initiatives*

Government Initiatives refer to policies, incentives, and support programs provided by the government (Nosheen & Omar, 2023). According to Julian *et al.* (2014), the implementation of government initiatives is essential for the support of small and medium-sized enterprises and new businesses in their investment in technologies that can enhance their performance and reduce costs. It is also imperative for governments to enforce laws that guarantee the security, privacy, and confidentiality of data (Abaidoo & Blankenberger, 2022). The critical role that government initiatives play in facilitating the adoption of cloud by small and medium-sized enterprises in developed countries has been emphasised in previous research conducted in Denmark and Australia (Amron, Ibrahim & Chuprat, 2017).

This research, therefore, proposes the hypothesis that:

Hypothesis 1(c) – H1c*: Government initiatives (GI) positively influence the adoption of cloud computing (CA)*

2.10.3 *Socioeconomic challenges*

Socioeconomic challenges refer to the social and economic influences (such as poverty, crime, and unemployment) that shape individuals' and communities' behaviours, opportunities, and outcomes (Udo et al., 2024). The disparity between tech-savvy urban elites and marginalised communities is further exacerbated by income inequality and poverty rates, which affect the affordability and purchasing power of technology devices and services (Chutani, Aalami & Badshah, 2010). Income inequality and poverty rates perpetuate disparities in digital access and opportunities for socio-economic advancement by affecting affordability and access to technology devices and high-speed internet (Udo et al., 2024).

This research, thus, formulates a hypothesis to the effect that:

Hypothesis 1(d) – H1d*: Socioeconomic challenges (SE) negatively influence the adoption of cloud computing (CA)*

2.10.4 *Political challenges*

Political challenges refer to obstacles or issues arising from government policies, regulations, political stability, or other aspects of the political environment (Skafi, Yunis & Zekri, 2020). These challenges include factors such as political unrest, corruption, and complex policies which can significantly influence the adoption of cloud computing (Skafi, Yunis & Zekri, 2020). For example, data privacy policies are some of the political factors that impact cloud adoption decisions in businesses (Avram, 2014). This is because it is not always clear where data is stored, accessed, or processed; various areas may have different privacy standards and regulations different regions may have different privacy rules and regulations (Avram, 2014).

Consequently, the following hypothesis could be postulated:

Hypothesis 1(e) – H1e*: Political challenges (PO) negatively influence the adoption of cloud computing (CA)*

2.11 The conceptual framework

The theoretical framework by Skafi, Yunis and Zekri (2020) was deemed appropriate to form a basis for addressing the research question "To what extent do contextual factors influence the adoption of cloud computing technology in SMMEs located in the townships of Gauteng Province, South Africa?".

For this study, the framework was adapted to focus only on the two constructs: Context-based Factors, and the Adoption of Cloud Computing. The specific factors included in this study are adapted based on empirical findings from studies focusing on the adoption of cloud computing in SMMEs and the unique contextual challenges faced by businesses in developing regions (Skafi, Yunis & Zekri, 2020). FIGURE 7 depicts the conceptual framework that was adopted for this study.

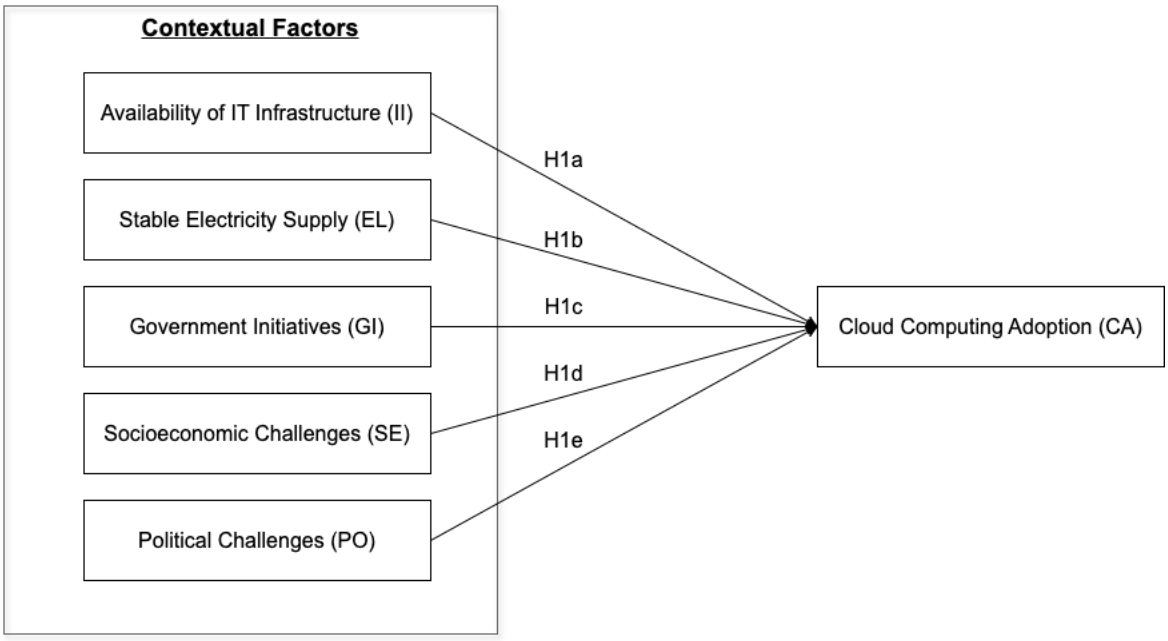


FIGURE 7: The research conceptual framework

The conceptual framework provides a view of the contextual factors influencing cloud computing adoption in SMMEs within Gauteng townships, offering a structured basis for investigating the research question. It is made up of six (6) constructs: five predictors (independent) variables: availability of IT infrastructure, stable electricity supply, government initiatives, socioeconomic challenges, and

political challenges; and cloud computing adoption (an outcome, dependent variable). The model proposes that the adoption of cloud computing is predicted by contextual factors: availability of IT infrastructure, stable electricity supply, government initiatives, socioeconomic challenges, and political challenges.

The essential pillars of the suggested conceptual framework are the integrated framework of DOI, TOE and context-based factors by Skafi, Yunis and Zekri (2020), which was used to support this study.

2.12 Summary of the chapter

This chapter provided an overview of the literature on cloud computing, with a specific focus on its utilisation by SMMEs. The objective of this chapter was to examine the factors that influence the adoption of cloud computing by SMMEs in Gauteng townships. Various technology adoption models were examined to provide an appropriate theoretical framework for this study. The theoretical framework by Skafi, Yunis and Zekri (2020) was found to be the best model for this study to understand the contextual factors that influence the adoption of cloud computing by SMMEs in Gauteng townships. The next chapter provides an account of the research design, sample methodology, and data collection instrument employed in the study.

3. RESEARCH METHODOLOGY

3.1 Introduction

The research methodology section provides a comprehensive overview of the systematic approach employed to investigate the adoption of cloud computing by SMMEs in Gauteng townships, South Africa. Building on the insights gained from the literature review, this section outlines the research methodology, design, setting for the study and procedures used to gather and analyse data relevant to the study's objectives. The study utilises a quantitative research methodology, allowing for the collection of empirical data that can be statistically analysed to identify patterns and relationships. This section also details the sampling strategy employed to ensure a representative sample of SMMEs, the data collection methods using both online and paper-based questionnaires, and the research instrument designed to capture a wide range of information on the factors influencing cloud computing adoption. Furthermore, it discusses the ethical considerations that were considered to ensure the integrity and confidentiality of the research process.

3.2 Research approach

This study employed a quantitative research approach to investigate the factors influencing the adoption of cloud computing by SMMEs in Gauteng townships, South Africa. The quantitative approach is chosen for its ability to objectively measure variables, analyse relationships between them, and generate statistically significant results that can be generalised to a larger population (Cooper & Schindler, 2011). By using structured data collection methods such as questionnaires, this approach facilitates the collection of numerical data that can be analysed using statistical techniques (Creswell & Creswell, 2018). This approach also enables the testing of hypotheses and the identification of patterns or trends within the data (Cooper & Schindler, 2011). The quantitative research approach is particularly suited for this study as it allows for the systematic investigation of a wide range of potential influences on cloud computing adoption,

ensuring that the findings are based on empirical evidence and can be used to inform both academic understanding and practical decision-making in the context of SMMEs in Gauteng townships.

3.3 Research design

This study adopted a cross-sectional survey research design to explore the factors influencing the adoption of cloud computing by SMMEs in Gauteng townships, South Africa. A cross-sectional design involves collecting data from a sample at a single point in time, making it an effective method for capturing a snapshot of current practices, perceptions, and conditions (Creswell & Creswell, 2018). This design is particularly suitable for the study as it allows for the examination of relationships between variables, such as the impact of technological awareness or political challenges on cloud computing adoption, without the need for long-term data collection. The cross-sectional approach is advantageous because it provides a relatively quick and cost-effective means of gathering data from a large number of respondents (Bryman, 2016). It enables the researcher to identify patterns and correlations between different factors influencing cloud computing adoption, providing valuable insights into the current state of technology adoption among SMMEs in the selected townships. However, it is important to note that while this design is effective for describing associations, it does not allow for the determination of causality due to its single-time-point nature (Brill, 2013).

3.4 Setting

This study sought to explore the key contextual factors influencing the adoption of cloud computing technology in SMMEs located in townships within Gauteng, South Africa. Gauteng is the country's economic hub, comprising major cities such as Johannesburg and Pretoria, and is known for its diverse range of businesses, including a significant number of SMMEs operating in township areas (Rogerson, 2001).

The townships in Gauteng provide a unique setting for this study due to their distinct socioeconomic characteristics and the diverse challenges faced by SMMEs in these areas. These townships are characterised by varying levels of infrastructure development, access to technology, and educational attainment, all of which can impact the adoption of cloud computing technology (Rogerson, 2001). The specific townships selected for this study include Soweto, Alexandra, Mamelodi, Kagiso, Kwa-Thema, Vosloorus, Sebokeng, and Tembisa, which are representative of the broader township landscape in Gauteng.

3.5 Sampling

Sampling is a critical aspect of research methodology, determining the representativeness and generalisability of the study's findings (Creswell & Creswell, 2018). This section outlines the sampling strategy employed in this study, detailing the population, sample, and sampling methods used in this study

3.5.1 *Population*

The population for this study consists of all SMMEs operating within the townships of Gauteng, South Africa. Gauteng, as the economic hub of South Africa, has a high concentration of SMMEs, many of which are located in townships where businesses often face unique socioeconomic challenges. The population includes a diverse range of SMMEs across various industries, including retail, manufacturing, services, and more. Given the heterogeneity of this population, it is crucial to select a sample that accurately reflects the diversity of SMMEs in these townships. Based on the Finscope report from 2021, there are a total of 283,475 registered SMMEs in South African townships (Finscope, 2021). Out of these, 41% are located in Gauteng, which amounts to a total of 116,225 SMMEs (Finscope, 2021).

3.5.2 *Sample*

The sample for this study was drawn from the broader population of SMMEs in Gauteng townships. The sample size was determined using the formula by Fuller (2011) for sample size calculation, ensuring a 95% confidence level and a 5%

margin of error. A total sample size of 381 SMMEs was determined to provide sufficient data for both quantitative and qualitative analyses. The sample included SMMEs of varying sizes, ages, and industries to capture a comprehensive picture of cloud computing adoption. This sample size is chosen based on the need to balance feasibility and the statistical power required for meaningful analysis.

3.5.3 *Sampling Method*

The study employed a combination of multistage sampling and random sampling techniques to select the sample.

In the first stage, a multistage sampling method was used to identify specific townships within Gauteng that will be included in the study. The selection of townships was based on criteria such as economic activity, business density, and accessibility. This method allowed the researcher to focus on townships that are most relevant to the research objectives.

In the second stage, a random sampling technique is employed within the selected townships to choose individual SMMEs for inclusion in the sample. Random sampling was utilised to minimise selection bias and ensure that each SMME that was selected for face-to-face paper-based surveys within the selected townships had an equal chance of being included in the study. Furthermore, the survey was shared with the small business development agency, Gauteng Enterprise Propeller for distribution to the SMMEs listed with them. This approach was deemed appropriate to enhance the representativeness of the sample, making the findings more generalisable to the broader population of SMMEs in Gauteng townships.

3.6 Research instrument

The primary research instrument for this study is a structured questionnaire, designed for use in online and paper-based forms, to systematically gather quantitative data on the contextual factors influencing cloud computing adoption by SMMEs in Gauteng townships, South Africa. The structured questionnaire allowed for the collection of specific, comparable data from a large number of

respondents, making it an effective tool for statistical analysis (Creswell & Creswell, 2018).

The questionnaire was adapted from Skafi, Yunis and Zekri (2020) and comprised 34 questions that relate to the objective of the study. The research scales were implemented, primarily based on prior research, particularly that of Skafi, Yunis and Zekri (2020). Appropriate adjustments were implemented to ensure their compatibility with the present research setting and objective.

The questionnaire was divided into two sections: demographic information and contextual factors. The demographic information section was used to collect basic information about the SMME, including the size of the enterprise, industry type, and years in operation. This information is essential for understanding the context of the responses and ensuring a representative sample (Bryman, 2016). The contextual factors section was used to investigate the impact of contextual factors such as stable electricity supply, regulatory issues, and socioeconomic challenges on the decision to adopt cloud computing (Skafi, Yunis & Zekri, 2020). The contextual factors section employed closed-ended questions using Likert scales to gauge attitudes and perceptions towards various aspects of cloud computing adoption. The instrument is shown in Appendix A.

The questionnaire was pilot-tested with a small sample of SMMEs to identify any issues with question clarity or layout. This step was to ensure that the questions were understandable and that the instrument effectively captured the intended information (Bryman, 2016). Feedback from the pilot test was used to refine and improve the questionnaire before it was distributed to the larger sample. The questionnaire also underwent a rigorous process of validation with academic practitioners and subject matter experts to ensure that it accurately measures the constructs it is intended to assess. Reliability tests, such as Cronbach’s alpha, were also conducted to check the internal consistency of the scale items (Creswell & Creswell, 2018).

3.7 Data collection

The data collection process is a critical component of this study, as it involves gathering the necessary information to address the research objectives and test the hypotheses. In this study, data were collected using a combination of online and paper-based questionnaires. This mixed-methods approach was chosen to ensure broad accessibility and to accommodate the diverse technological capabilities of SMMEs in Gauteng townships.

3.7.1 *Administration of questionnaires*

To reach a broad and representative sample, the questionnaires were distributed both online and in paper form. The online questionnaire was designed and hosted on Qualtrics. The link to the questionnaire was distributed via email to the small business development agency, Gauteng Enterprise Propeller for distribution to the SMMEs listed with them. Social media platforms: WhatsApp and Telegram were also used to distribute the questionnaire link to various groups, leveraging the convenience and efficiency of digital communication. This method was particularly effective for reaching SMMEs that are already somewhat tech-savvy or have regular internet access (Creswell & Creswell, 2018).

Paper-based questionnaires were distributed in person within selected townships in Gauteng to ensure the inclusion of SMMEs with limited or no internet access. This method was crucial for capturing responses from SMMEs that might otherwise be excluded due to technological or infrastructural limitations (Bryman, 2016). The in-person distribution also allowed the researcher to explain the study and address any questions from respondents, potentially increasing the response rate and the accuracy of the data collected.

The questionnaires were accompanied by the participant information sheet introducing the research and its purpose as detailed in Appendix B. The questionnaire also included a letter of consent that was used to seek consent from participants. This is detailed in Appendix C. The estimated time taken to complete the questionnaire ranged between ten (10) and fifteen (15) minutes.

3.7.2 *Data Collection Process*

The data collection process spanned approximately three months, allowing sufficient time for the distribution, completion, and return of questionnaires. Follow-up reminders were sent to non-respondents to maximise response rates, particularly for the online questionnaires, where drop-off rates are typically higher (Bryman, 2016).

The mixed-methods approach to questionnaire distribution ensured that the study captured a diverse and representative sample of SMMEs, thereby enhancing the reliability and validity of the findings. By using both online and paper-based methods, the study mitigated potential biases related to access and technological proficiency, ensuring that the data collected accurately reflects the experiences and perceptions of SMMEs across Gauteng townships.

Furthermore, to encourage participation, respondents were assured of the confidentiality of their responses and the anonymity of their data as all answers were directed towards the construction of the Qualtrics database (Saunders et al., 2016). The research received 67 respondents.

3.8 Validity and Reliability

Ensuring the validity and reliability of the research instruments is essential to producing trustworthy and credible results. This study takes several measures to establish both the validity and reliability of the data collected through the questionnaires.

3.8.1 *Validity*

Validity refers to the extent to which the research instrument measures what it is intended to measure (Creswell & Creswell, 2018). To ensure content validity, the questionnaire was carefully designed to cover all relevant aspects of cloud computing adoption, including technological awareness, and contextual factor influences. The content was informed by a thorough review of the literature and

expert input, ensuring that the questions were comprehensive and aligned with the study's objectives (Saunders et al., 2016).

Construct validity was addressed by ensuring that the questions accurately reflect the theoretical concepts being studied. For instance, items related to contextual factors influences were based on established frameworks and previous studies, ensuring that the constructs are measured consistently (Bryman, 2016). Additionally, a pilot test was conducted with a small sample of SMMEs to evaluate the clarity and relevance of the questions. Feedback from the pilot test led to minor revisions, enhancing the instrument's validity.

Criterion-related validity was considered by comparing the study's findings with existing research on similar topics. Consistency with previous studies on cloud computing adoption by SMMEs provides further assurance that the instrument accurately captures the constructs of interest (Creswell & Creswell, 2018).

3.8.2 *Reliability*

Reliability refers to the consistency and stability of the measurement process (Bryman, 2016). A research instrument is considered reliable if it produces similar results under consistent conditions. To ensure internal reliability, the study employed Cronbach's alpha to assess the consistency of the responses within each section of the questionnaire. A Cronbach's alpha value of 0.7 or higher is generally considered acceptable, indicating that the items within a scale are measuring the same underlying concept (Bryman, 2016).

To enhance external reliability, the study used standardised procedures for administering the questionnaires, whether online or in person. The same instructions and explanations were provided to all respondents, minimising the potential for variability in how the questions were interpreted or answered (Saunders et al., 2016). Additionally, the mixed-methods approach (using both online and paper-based questionnaires) helps to ensure that the results are not unduly influenced by the mode of data collection.

The pilot test conducted before the main data collection phase also contributed to the reliability of the study. By identifying and addressing any issues with the

questionnaire's wording or structure, the pilot test helped to ensure that the instrument would yield consistent and reliable data during the full-scale study (Bryman, 2016). By carefully addressing both validity and reliability, this study ensured that the findings were both accurate and dependable, providing a solid foundation for understanding the factors influencing cloud computing adoption among SMMEs in Gauteng townships.

3.9 Data analysis

The data analysis process is a critical phase in the research methodology, as it involves interpreting the data collected to answer the research questions and test the hypotheses. In this study, a variety of statistical techniques were employed to analyse the data gathered from the questionnaires, ensuring a thorough examination of the factors influencing cloud computing adoption among SMMEs in Gauteng townships.

3.9.1 *Data Preparation*

Before analysis, the data collected from both online and paper-based questionnaires were first entered into a statistical software package, IBM SPSS (Statistical Package for the Social Sciences), for processing. The data was cleaned to ensure accuracy, which involved checking for missing values, outliers, and inconsistencies (Pallant, 2020). Missing data were handled using appropriate methods, such as pairwise deletion, depending on the extent and nature of the missing information (Saunders et al., 2016).

3.9.2 *Descriptive Statistics*

Descriptive statistics were used to summarise and describe the characteristics of the sample. This included calculating measures of central tendency (mean, median, mode) and measures of dispersion (standard deviation, range) for the key variables (Bryman, 2016). These statistics provided an overview of the demographic characteristics of SMMEs, such as size, industry, and technological capabilities, as well as their attitudes toward cloud computing. Frequency distributions and percentages were also used to present the data in a clear and

interpretable format, helping to identify general trends and patterns within the sample (Bryman, 2016).

3.9.3 *Inferential Statistics*

Inferential statistical techniques were employed to test the hypotheses and examine relationships between variables. Correlation analysis was used to explore the strength and direction of the relationships between factors such as government initiatives, socioeconomic challenges, and cloud computing adoption (Pallant, 2020). Pearson's correlation coefficient (r) was calculated to assess the degree of linear association between pairs of variables.

For hypothesis testing, regression analysis was conducted to determine the impact of various independent variables (e.g., stable electricity supply, and availability of IT infrastructure) on the dependent variable (cloud computing adoption). Multiple regression analysis was particularly useful in identifying the relative importance of different predictors and controlling for potential confounding variables (Creswell & Creswell, 2018).

Additionally, Chi-square tests were used to examine the relationships between categorical variables, such as the type of industry and the likelihood of cloud computing adoption (Bryman, 2016). This non-parametric test provided insights into whether certain types of businesses are more likely to adopt cloud computing technologies based on their characteristics.

3.9.4 *Data Interpretation*

The results of the statistical analyses were interpreted in the context of the research questions and hypotheses. Patterns and trends identified through descriptive statistics provided a foundation for understanding the general landscape of cloud computing adoption among SMMEs. The inferential statistics, particularly the regression analysis, offered deeper insights into the factors that significantly influence this adoption. These findings were then compared to existing literature to assess their consistency with previous research and to identify any new contributions made by the study (Saunders et al., 2016).

3.9.5 *Software and Tools*

The analysis was primarily conducted using statistical software: IBM SPSS version 28, which is widely recognised for its robust capabilities in handling and analysing complex datasets (Pallant, 2020). This tool facilitated the efficient processing of data, allowing for both basic and advanced statistical analyses to be performed with accuracy and precision.

Through this rigorous data analysis process, the study was able to generate reliable and valid findings that contribute to a deeper understanding of the contextual factors influencing cloud computing adoption among SMMEs in Gauteng townships.

3.10 Ethical considerations

An application for full ethical approval was made to the Wits Business School Ethics Committee and ethics consent was received on 09 November 2023. The ethics approval number is WBS/BA9404687M/489.

The techniques conducted in studies involving human participants adhered to the ethical criteria set by the institutional and/or national research committee, as well as the 1964 Helsinki Declaration and its subsequent revisions, or equivalent ethical norms.

All individual participants included in the study provided written informed permission.

3.11 Summary of the chapter

The research methodology chapter provided a comprehensive overview of the approach adopted to explore the adoption of cloud computing among SMMEs in Gauteng townships. This study employed a quantitative research design, which is well-suited to examining the relationships between various contextual factors and cloud computing adoption. The use of a structured questionnaire with a combination of multistage and random sampling techniques ensured that the data collected were representative of the target population, thereby enhancing the

reliability and validity of the findings. The detailed procedures for data collection and analysis—employing multiple regression analysis—allowed for an in-depth understanding of how factors such as IT infrastructure, stable electricity supply, government initiatives, socioeconomic challenges, and political challenges influence cloud adoption. The ethical considerations outlined in this chapter underscored the commitment to conducting research with integrity and respect for participants' rights. By obtaining informed consent and ensuring confidentiality, the study adhered to ethical research standards. In summary, this chapter established a solid foundation for analysing the data and interpreting the results, setting the stage for a meaningful discussion of how various factors impact cloud computing adoption in the context of SMMEs in Gauteng townships. The methodology outlined here ensures that the research findings were robust, insightful, and relevant to stakeholders seeking to understand and address the barriers and enablers of cloud computing adoption in similar settings.

4. PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents the results of the study on the contextual factors influencing the adoption of cloud computing by SMMEs in Gauteng townships. The findings are organised according to the research objectives and are presented using both descriptive and inferential statistics, where applicable. The chapter starts with a description of the data screening process, followed by an analysis of the demographic information of the respondents. Subsequently, comprehensive findings about the contextual factors are presented.

4.2 Data screening

Before the analysis of the collected data, a rigorous data screening process was conducted to ensure the integrity and validity of the results. The screening involved several key steps. Firstly, the dataset was reviewed for completeness, and any missing values were identified. Instances of missing data were addressed through pairwise delete and appropriate imputation techniques, ensuring that they did not bias the analysis. Outliers were detected using statistical methods and visual inspections, such as box plots, and were evaluated for their impact on the overall results. Outliers that were deemed erroneous or beyond a reasonable range were removed from the dataset to prevent skewed interpretations. Additionally, the data was assessed for consistency, with attention given to ensuring that responses were logically coherent and adhered to predefined criteria. Duplicate entries were identified and removed to avoid redundancy. Finally, the data was checked for normality and other assumptions relevant to the statistical tests used in subsequent analyses. The rigorous screening process ensured that the dataset was robust, reliable, and suitable for addressing the research questions and hypotheses. This preparatory work laid a solid foundation for the accurate and credible presentation of the results.

4.3 Demographic profile of respondents

In this study, a total of fifty-six(56) respondents from SMMEs in Gauteng townships participated. The demographic profile of the respondents provides insights into the characteristics of the sample and helps contextualise the results of the study. Descriptive statistics were calculated to summarise the demographic characteristics of the sample and the main variables of interest. The demographic profile of respondents included factors such as the location of the firm, size, turnover, business sector, and years in operation. The following sections detail the key demographic factors.

4.3.1 *Location distribution*

The results indicate that the respondents were mostly located in the City of Tshwane (28.60%), City of Johannesburg (19.60%), Midvaal (12.50%), and Mogale City (10.70%). The rest of the respondents are from various other areas of the Gauteng province. FIGURE 8 depicts the location distribution of the sample.

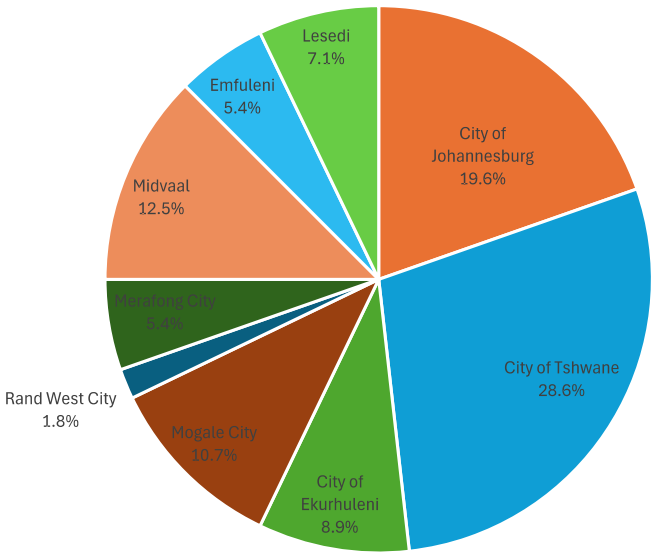


FIGURE 8: Location distribution

4.3.2 *Age distribution*

The results show that the majority of the SMMEs are in the 1-3 years age group (33.9%), followed by the 4-6 years age group (26.8%). The less than one year age group occupies the third position (23.2%), followed by the more than 10 years age group (10.7%). Finally, the 7-10 years age group occupies the last position (5.4%). FIGURE 9 shows the distribution based on the age of the SMMEs.

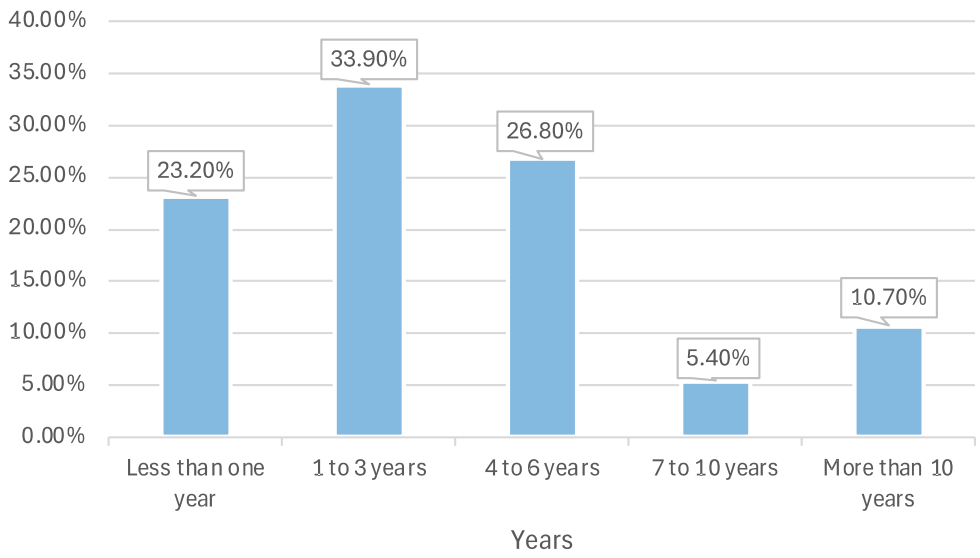


FIGURE 9: SMME age distribution

4.3.3 *Business size*

The results show that around 53.6% of the respondents are micro-businesses (with 1-5 employees), 19.6% are medium businesses (with 51-200 employees), 14.3% are small businesses (with 21-50 employees), and 12.5% are very small businesses (with 6-10 employees).

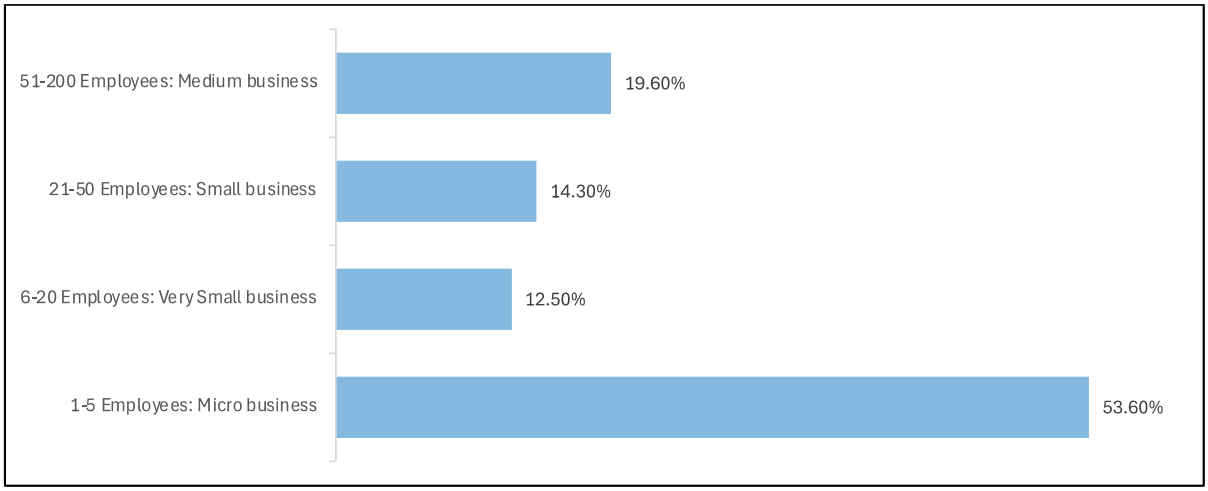


FIGURE 10: Distribution by business size

4.3.4 *Cloud computing usage*

Interestingly, 53.6% of the respondents use cloud computing in some form as shown in FIGURE 11.

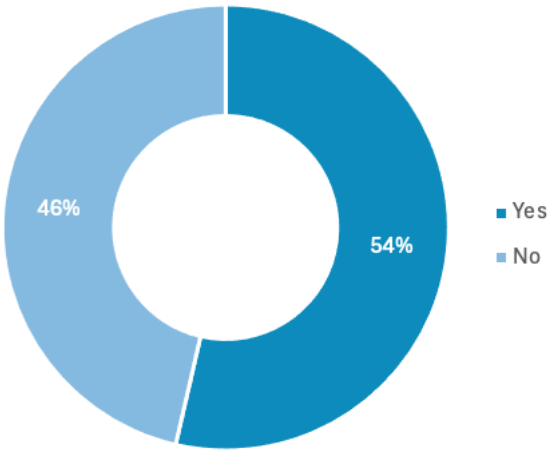


FIGURE 11: Cloud usage

4.3.5 *Other demographic characteristics*

Error! Not a valid bookmark self-reference. shows other demographics of the sample such as the distribution based on the sector the SMME operates in, SMME annual turnover and the level of knowledge in cloud computing.

TABLE 2: Other demographic characteristics

Variable	Value	*N*	%
Sector	Accommodation and Food Services	7	12.50%
	Administrative and Support Services	2	3.57%
	Agriculture, forestry, fishing and hunting	2	3.57%
	Arts, Entertainment and Recreation	1	1.79%
	Educational Services	3	5.36%
	Finance and Insurance	1	1.79%
	Health care and Social Assistance	2	3.57%
	Information Technology	1	1.79%
	Management of Companies and Enterprises	2	3.57%
	Manufacturing	5	8.93%
	Mining, Quarrying, and Oil and Gas Extraction	4	7.14%
	Professional, Scientific and Technical Services	5	8.93%
	Public Administration	1	1.79%
	Real Estate, Rental and Leasing	4	7.14%
	Retail Trade	1	1.79%
	Transportation and Warehousing	6	10.71%
	Utilities	1	1.79%
	Waste Management and Remediation	1	1.79%
	Wholesale Trade	3	5.36%
	Other Services (Except Public Administration)	3	5.36%
	Missing System	1	1.79%
Turnover	R0 - R150 000	23	41.10%
	R150 001 - R500 000	13	23.20%
	R500 001 - R 25 000 000	14	25.00%
	R25 000 001 - R50 000 000	6	10.70%
Cloud Knowledge	I have no information and knowledge about cloud computing	11	19.60%
	I have little information and knowledge about cloud computing	18	32.10%
	I have some information and knowledge about cloud computing	13	23.20%
	I have a good understanding about cloud computing	8	14.30%
	I have an excellent information and knowledge about cloud computing	6	10.70%

4.4 Checking for Normality

Normality tests are essential to determine if the data follows a normal distribution, which is a common assumption for many statistical tests (Field, 2013). Deviations from normality can affect the validity of parametric tests and lead to inaccurate conclusions.

Descriptive statistics such as skewness and kurtosis offer initial insights into the shape of the data distribution (Kline, 2016). Skewness measures the asymmetry of the distribution, while kurtosis assesses the "tailedness" (Tabachnick & Fidell, 2017).

For the dataset under examination, all skewness and kurtosis values for the indicator variables are between -2 and +2. The results indicate that the data is normally distributed (Hair et al., 2014). TABLE 3 shows the descriptive statistics of the indicator variables.

TABLE 3: Descriptive statistics

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
CA1	44	3.39	1.243	-.337	.357	-.739	.702
CA2	42	3.02	1.220	.207	.365	-.789	.717
CA3	43	1.98	1.012	.627	.361	-.780	.709
II1	56	3.38	1.315	-.638	.319	-.777	.628
II2	56	3.55	1.426	-.756	.319	-.780	.628
II3	56	3.27	.944	-.167	.319	-.011	.628
II4	56	3.36	1.197	-.209	.319	-.765	.628
EL1	56	3.14	1.407	-.303	.319	-1.233	.628
EL2	56	3.29	1.275	-.345	.319	-.983	.628
EL3	56	3.09	1.352	-.076	.319	-1.255	.628
EL4	56	3.07	1.291	-.085	.319	-1.013	.628
SE1	56	3.27	1.258	-.531	.319	-.696	.628
SE2	56	3.55	1.264	-.826	.319	-.198	.628
SE3	56	3.46	1.190	-.717	.319	-.163	.628
SE4	56	3.52	1.112	-.582	.319	-.338	.628
SE5	56	3.20	1.166	-.541	.319	-.287	.628
GI1	56	2.61	1.201	.358	.319	-.785	.628
GI2	56	2.55	1.264	.295	.319	-.975	.628
GI3	56	2.98	1.228	-.148	.319	-.839	.628
GI4	56	2.98	1.000	.037	.319	-.106	.628
PO1	56	2.91	1.325	-.025	.319	-1.307	.628
PO2	56	3.14	1.212	-.030	.319	-.903	.628
PO3	56	3.07	1.277	-.192	.319	-.905	.628
PO4	55	2.95	1.339	-.041	.322	-1.255	.634
Valid N (listwise)	41						

4.5 Validity Analysis

Construct validity refers to the extent to which the measurement instruments used in this study accurately represent the theoretical constructs they are intended to measure (Hair et al., 2014). To assess construct validity, two primary techniques were employed: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). The results from these analyses are presented below.

4.5.1 *Exploratory Factor Analysis (EFA)*

EFA was conducted to identify the underlying structure of the data and to ensure that the items grouped into their respective constructs as expected. The principal component analysis (PCA) method with Varimax rotation was applied, and the following results were obtained:

4.5.1.1 Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy

The Kaiser-Meyer-Olkin (KMO) measure was used to assess the adequacy of the sample size for conducting factor analysis (Kaiser & Ford, 1984). The KMO value obtained was 0.620, as indicated in TABLE 4. This value falls into the range of "mediocre" (Edwards & Bagozzi, 2000). While this value is above the minimum threshold of 0.50, indicating that factor analysis is still appropriate, it suggests that the correlations among items are only moderately adequate for identifying distinct factors (Edwards & Bagozzi, 2000).

TABLE 4: KMO and Bartlett's test results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.620
Bartlett's Test of Sphericity	Approx. Chi-Square	416.703
	df	190
	Sig.	<.001

4.5.1.2 Bartlett's Test of Sphericity

Bartlett's Test of Sphericity shown in TABLE 4 was significant ($\chi^2 = 416.703$, $p < 0.001$), indicating that the correlation matrix was significantly different from an identity matrix, where variables would be uncorrelated (Shrestha, 2021). This

result supports the use of EFA, as it suggests that the items share enough common variance to justify the extraction of factors (Shrestha, 2021).

4.5.1.3 Factor extraction and loadings

Factor extraction was initially performed using PCA with Varimax rotation. The initial analysis suggested the presence of six factors with eigenvalues greater than 1. However, upon further examination, it became apparent that one of the factors did not contribute meaningfully to the model. This factor had low factor loadings across two items, and the items associated with it did not form a coherent construct. As a result, the decision was made to drop this factor, resulting in a final five-factor solution. This decision is supported by Hair et al. (2014), who recommend refining the factor structure by removing poorly loading factors to improve model interpretability and construct validity.

As shown in TABLE 5, the final five factors exhibited satisfactory loadings, with the loadings ranging from 0.518 to 0.881 on their respective factors. This suggests that the remaining factors are relatively robust despite the initial concerns about sampling adequacy.

TABLE 5: Rotation component matrix

		Factors					
Id	Item	1	2	3	4	5	6
CA1	My business intends to adopt cloud computing in the next 12 months.						0.847
CA2	My business plans to implement cloud computing in the next 12 months.						0.786
CA3	My business intends to stop using cloud computing in the next 12 months.						
II1	I have reliable internet connectivity in my area for my business.					0.848	
II2	I have access to modern computing devices (e.g.,					0.781	

	computers, laptops, smartphones) to use for my business.				
II3	I have adequate technical support and expertise for IT infrastructure for my business.				0.707
II4	My business allocates enough budget for IT infrastructure (e.g., cost of internet services, hardware)				0.718
EL1	I have a reliable power supply for my business.		0.672		
EL2	My business can afford to pay for electricity.		0.789		
EL3	I have additional backup power supply for my business.		0.819		
EL4	Electricity issues are resolved quickly in my business area.		0.8		
SE1	Poverty is prevalent in my business area.	0.836			
SE2	Unemployment is prevalent in my business area.	0.864			
SE3	Crime is prevalent in my business area.	0.822			
SE4	Cloud computing knowledge and skills are rare in my business area.	0.682			
SE5	There is adequate support and training by cloud computing vendors in my business area	0.512			
GI1	Government provides incentives for small businesses to adopt cloud computing technologies.			0.88	
GI2	Government creates adequate cloud computing initiatives in my business area (such as setting up the facilities to enable cloud computing).			0.822	
GI3	The country's laws and regulations are sufficient to			0.807	

	protect the use of cloud computing.		
GI4	The country's laws and regulations facilitate the use of cloud computing.	0.724	
PO1	The political climate in my business area supports the growth of small businesses.		0.861
PO2	Authorities can gain unauthorised access to my company's sensitive data if stored in the cloud.		0.732
PO3	Politics in my business area are stable and predictable		0.762
PO4	Political factors, such as taxation policies and incentives favour small businesses.		0.714

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 6 iterations.

FIGURE 12 below illustrates the scree plot from the EFA. Initially, the plot suggested six factors, but the final model includes five factors based on the interpretability and contribution of each factor.

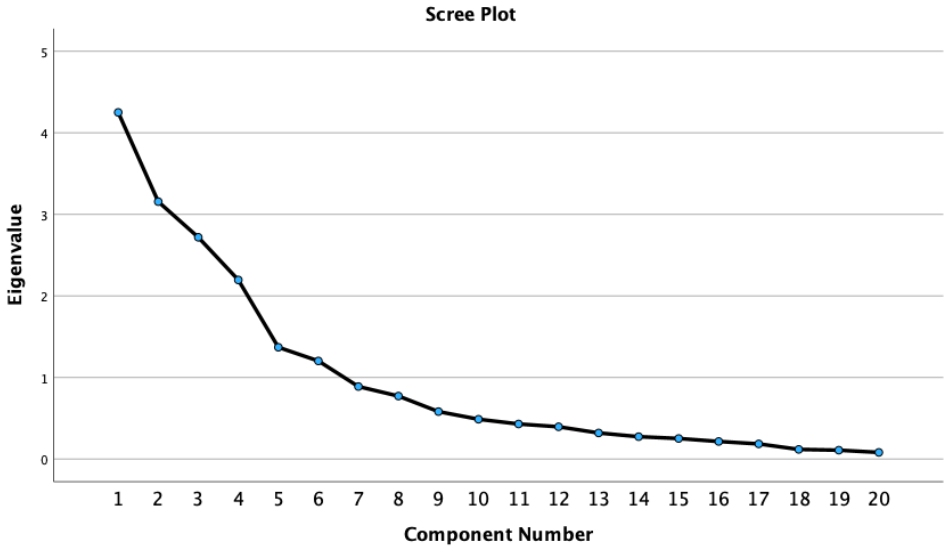


FIGURE 12: Scree plot

The scree plot revealed an elbow after the sixth factor, suggesting that six factors should be retained.

4.5.1.4 Interpretation of findings

The final five-factor solution explained 68.45% of the total variance, as shown in TABLE 6. This is adequate for this study, although slightly lower than the preferred level due to the marginal KMO value (Field, 2013). The decision to drop the sixth factor improved the overall model by ensuring that the remaining factors were more clearly defined and interpretable.

However, due to the mediocre sampling adequacy, the results should be interpreted with caution. This cautious approach aligns with Field (2013), who advises that marginal sampling adequacy can lead to less reliable factor solutions, necessitating additional validation steps. The moderate KMO value suggests that the factor structure might not be entirely stable, and further validation using CFA is recommended to confirm the robustness of these findings (Bryman, 2016).

TABLE 6: 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	4.250	21.249	21.249	4.250	21.249	21.249	3.135	15.677	15.677
2	3.156	15.779	37.028	3.156	15.779	37.028	3.116	15.579	31.255
3	2.719	13.593	50.621	2.719	13.593	50.621	2.986	14.930	46.185
4	2.196	10.978	61.600	2.196	10.978	61.600	2.581	12.903	59.088
5	1.370	6.851	68.450	1.370	6.851	68.450	1.872	9.362	68.450
6	1.203	6.013	74.463						
7	.889	4.443	78.906						
8	.772	3.859	82.766						
9	.581	2.907	85.672						
10	.488	2.438	88.111						
11	.430	2.148	90.258						
12	.395	1.977	92.236						
13	.320	1.598	93.833						
14	.274	1.370	95.204						
15	.251	1.257	96.461						
16	.215	1.075	97.537						
17	.185	.927	98.464						
18	.118	.589	99.053						
19	.108	.541	99.594						
20	.081	.406	100.000						

Extraction Method: Principal Component Analysis.

4.5.2 *Confirmatory Factor Analysis (CFA)*

Confirmatory Factor Analysis (CFA) was further conducted to test the validity of the proposed measurement model and to confirm the factor structure suggested by EFA. CFA allows for the evaluation of how well the observed data fit the hypothesised model, providing a more rigorous test of the construct validity.

4.5.2.1 Model fit indices

The fit of the CFA model was evaluated using several fit indices, including the Chi-square (χ^2) test, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). These indices provide a comprehensive view of how well the model fits the data. As recommended by Bryman (2016), and Hu and Bentler (1999), acceptable model fit is indicated by CFI and TLI values close to or above 0.90, RMSEA values below 0.08, and SRMR values below 0.08. TABLE 7 presents the model fit indices for the CFA.

TABLE 7: Model fit indices

				RMSEA 90% CI	
CFI	TLI	SRMR	RMSEA	Lower	Upper
0.83	0.80	0.11	0.09	0.07	0.11

The CFI value of 0.83 is below the generally accepted threshold of 0.90, indicating that the model does not adequately capture the covariance structure of the data. A CFI value below 0.90 suggests that the model may not be optimally specified or that there are issues with the measurement of the constructs (Hu & Bentler, 1999).

The TLI value of 0.80 further corroborates the suboptimal fit, as values below 0.90 indicate that the model could benefit from further refinement. The TLI, also known as the non-normed fit index, penalises for model complexity and, in this case, suggests that the model may be overly complex or that there are issues with the measurement model (Bryman, 2016).

The SRMR value of 0.11 exceeds the recommended maximum of 0.08, which indicates that there is a significant discrepancy between the observed and predicted correlations in the model. This higher-than-desired SRMR value suggests that the model does not adequately account for the relationships among the observed variables (Hu & Bentler, 1999).

The SRMR value of 0.11 exceeds the recommended maximum of 0.08, which indicates that there is a significant discrepancy between the observed and predicted correlations in the model. This higher-than-desired SRMR value suggests that the model does not adequately account for the relationships among the observed variables (Hu & Bentler, 1999).

4.5.2.2 Interpretation and Implications

The results of the CFA indicate that the hypothesised model does not fit the data as well as desired. The CFI and TLI values suggest that the model is not capturing the underlying structure of the data adequately. The elevated SRMR and RMSEA values further imply that there are discrepancies between the model's predictions and the actual data. These findings align with Bryman (2016), who emphasises the importance of model fit indices in determining the adequacy of a CFA model. When fit indices do not meet the recommended thresholds, it suggests that the model may require re-specification, including the addition or removal of factors, or the correlation of error terms.

Given these results, further refinement of the model is necessary. Potential modifications could include re-examining the factor structure, considering alternative models, or identifying problematic items that may not be well-aligned with their respective constructs. Additionally, adding more indicators to each factor or adjusting the model to account for potential cross-loadings may improve the fit. As noted by MacCallum et al. (1996), when RMSEA values indicate a mediocre fit, researchers should consider modifications to improve the model, such as simplifying the model or revising the hypothesised relationships between variables.

4.6 Reliability Analysis

Reliability analysis was conducted to assess the internal consistency of the measurement instruments used in this study. Internal consistency refers to the degree to which items within a scale are correlated, indicating that they measure the same underlying construct (George & Mallery, 2020). Cronbach's alpha is the most widely used statistic for this purpose, and it was applied to each construct in this study (George & Mallery, 2020).

4.6.1 *Overall reliability of scales*

Cronbach's alpha values were calculated for six constructs, as detailed in TABLE 8. The results indicated that most scales had strong internal reliability, with Cronbach's alpha values ranging from 0.779 to 0.863. These values reflect high levels of internal consistency, suggesting that the items within each construct reliably measure the intended dimensions. According to Cronbach (1951), alpha values above 0.70 are considered acceptable, and values above 0.80 are indicative of excellent reliability.

TABLE 8: Cronbach's alpha values for scales

Variable	Cronbach's α	Cronbach's α Based on Standardized Items	N of Items
CA	0.225	0.133	3
II	0.778	0.779	4
EL	0.862	0.863	4
SE	0.822	0.819	5
GI	0.850	0.850	4
PO	0.816	0.816	4

II, Availability of IT Infrastructure; EL, Electricity Supply; SE, Socioeconomic Challenges; GI, Government initiatives; PO, Stable Political Environment

4.6.2 *Specific Analysis of the CA Scale*

The CA scale, initially comprising three items, exhibited a standardised Cronbach's alpha of 0.133, as shown in TABLE 9. This low alpha value indicated poor internal consistency among the items.

TABLE 9: Reliability statistics for CA

Cronbach's α	Cronbach's α Based on Standardized Items	N of Items
.225	.133	3

The results of the individual item statistics indicated that the elimination of item CA3 would significantly improve the reliability of the scale. This observation is consistent with recommendations for scale refinement, where removing problematic items can enhance overall reliability (Field, 2013).

Subsequent analysis with the omission of CA3 resulted in a revised 2-item CA scale with a Cronbach's alpha of 0.815. This value is considered acceptable, indicating that the 2-item scale had satisfactory internal consistency.

TABLE 10 displays the reliability levels for the remaining constructs, all of which exhibited Cronbach's alpha values above 0.70. These values confirm that the scales used in the study had excellent reliability, ensuring that the measurement of each construct was consistent and dependable (Cronbach, 1951).

TABLE 10: Reliability analysis

Variable	Cronbach's α	Cronbach's α Based on Standardized Items	N of Items
CA	0.815	0.815	2
II	0.778	0.779	4
EL	0.862	0.863	4
SE	0.822	0.819	5
GI	0.85	0.85	4
PO	0.816	0.816	4

II, Availability of IT Infrastructure; EL, Electricity Supply; SE, Socioeconomic Challenges; GI, Government initiatives; PO, Stable Political Environment

The Cronbach's alpha values ranging from 0.779 to 0.863 indicate that the research components had high levels of internal reliability, affirming the robustness of the scales used in this study (George & Mallery, 2020).

4.7 Hypothesis testing

This section presents the results of hypothesis testing conducted using multilinear regression analysis to determine the influence of various contextual factors on the adoption of cloud computing by SMMEs in Gauteng townships. Multilinear regression analysis is a powerful statistical tool used to understand the relationship between one dependent variable and multiple independent variables (Bryman, 2016). Multilinear regression analysis was chosen as the primary statistical method for hypothesis testing in this study. This technique was found to be appropriate because the research sought to determine the strength and direction of the relationship between multiple independent variables (availability of IT infrastructure, stable electricity supply, government initiatives, socioeconomic challenges, and political challenges) and a single dependent variable (cloud computing adoption).

In essence, the hypotheses tested were:

> **H1a**: Availability of IT infrastructure (II) positively influences the adoption of cloud computing (CA).
>
> **H1b**: Stable electricity supply (EL) positively influence the adoption of cloud computing (CA).
>
> **H1c**: Government initiatives (GI) positively influence the adoption of cloud computing (CA).
>
> **H1d**: Socioeconomic challenges (SE) negatively influence the adoption of cloud computing (CA).
>
> **H1e**: Political challenges (PO) negatively influence the adoption of cloud computing (CA).

4.7.1 *Descriptive statistics*

Before delving into the regression results, descriptive statistics for the key variables were calculated to provide an overview of the data. TABLE 11 summarises these statistics.

TABLE 11: Descriptive statistics

	Mean	Std. Deviation	*N*
CA (dependent variable)	6.4048	2.28526	42
II	3.2679	1.01872	42
EL	3.0655	1.24089	42
SE	3.3190	1.01795	42
GI	2.7917	1.03582	42
PO	3.0694	1.11681	42

II, Availability of IT Infrastructure; EL, Electricity Supply; SE, Socioeconomic Challenges; GI, Government initiatives; PO, Stable Political Environment

The data reveal that on average, SMMEs in Gauteng townships have a high positive perception of cloud computing (Mean = 6.4048). Socioeconomic challenges had the highest mean score, indicating that respondents generally experience socioeconomic challenges.

4.7.2 *Multilinear regression analysis*

The multilinear regression model's performance is summarised in TABLE 12.

TABLE 12: Regression analysis summary

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	5.869	2.327		2.522	.016
	II	.040	.348	.018	.114	.910
	EL	-.672	.298	-.365	-2.258	.030
	SE	.055	.359	.024	.153	.879
	GI	.392	.347	.178	1.132	.265
	PO	.387	.336	.189	1.153	.257

Dependent Variable: CA
II, Availability of IT Infrastructure; EL, Stable Electricity Supply; SE, Socioeconomic Challenges; GI, Government initiatives; PO, Stable Political Environment

4.7.3 *Hypothesis testing results*

Based on the regression analysis results in TABLE 12., the hypotheses were tested as follows:

4.7.3.1 H1a: Availability of IT infrastructure (II) positively influences the adoption of cloud computing (CA)

The coefficient for IT Infrastructure (B = 0.040, p = 0.910) is not statistically significant. Therefore, H1a is not supported.

4.7.3.2 H1b: Stable electricity supply (EL) positively influence the adoption of cloud computing (CA)

The coefficient for Stable Electricity Supply (B = -0.672, p = 0.030) is statistically significant but negative. Thus, H1b is partially supported, as it influences adoption but in the opposite direction.

4.7.3.3 H1c: Government initiatives (GI) positively influence the adoption of cloud computing (CA)

The coefficient for Socioeconomic Challenges (B = 0.055, p = 0.879) is not statistically significant. Therefore, H1c is not supported.

4.7.3.4 H1d: Socioeconomic challenges (SE) negatively influence the adoption of cloud computing (CA)

The coefficient for Government Initiatives (B = 0.392, p = 0.265) is not statistically significant. Therefore, H1d is not supported.

4.7.3.5 H1e: Political challenges (PO) negatively influence the adoption of cloud computing (CA)

The coefficient for Political Challenges (B = 0.387, p = 0.257) is not statistically significant. Therefore, H1e is not supported.

TABLE 13 provides a summary of the hypothesis testing results.

TABLE 13: Hypothesis testing results

Construct	Hypothesis		Outcome
Availability of IT	H1a	Availability of IT infrastructure positively influences the adoption of cloud computing	Not supported
Stable electricity supply	H1b	Stable electricity supply positively influences the adoption of cloud computing	Supported
Government initiatives	H1c	Government initiatives positively influence the adoption of cloud computing	Not supported
Socioeconomic challenges	H1d	Socioeconomic challenges negatively influence the adoption of cloud computing	Not supported
Political challenges	H1e	Political challenges negatively influence the adoption of cloud computing	Not supported

4.8 Summary of the chapter

The analysis of data in this study reveals a complex and nuanced picture of the factors influencing cloud computing adoption among SMMEs in Gauteng townships. While certain expected factors like IT infrastructure, government initiatives, socioeconomic challenges, and political challenges did not show significant effects, the unexpected negative relationship between stable electricity supply and cloud adoption indicates a unique interplay of local factors that merits further investigation. The Confirmatory Factor Analysis provided partial support for the factor structure identified in the Exploratory Factor Analysis, but the less-than-optimal fit indices suggest that the model may not fully capture the underlying relationships among the constructs. This indicates the need for future research to refine the model, potentially by revisiting the theoretical framework,

collecting additional data, or applying alternative analytical approaches. Although the reliability of the scales used in this study was generally high, the research suggests that the Cloud Adoption (CA) scale could be enhanced by incorporating additional items to provide a more comprehensive measure and improve reliability. Field (2013) suggests that adding more items can enhance the scale's validity and reliability, particularly in cases where initial results indicate moderate reliability. These findings challenge existing theoretical perspectives and underscore the complexity of cloud adoption in this context, highlighting areas for further investigation. The subsequent discussion chapter will explore these results in greater depth, considering their implications for both theory and practice.

5. DISCUSSION OF RESULTS

5.1 Introduction

This section analyses the findings of the current research and examines any similarities or discrepancies between the current study and past research studies. The discussion examines each theory and also contrasts the current findings with those from prior studies. The overall discussion also answers the study's research question "To what extent do the key contextual factors influence the adoption of cloud computing technology by SMMEs operating in Gauteng Province's township economies?".

5.2 Key findings

The study explored the contextual factors that influence the adoption of cloud computing technology by SMMEs operating in Gauteng townships in South Africa. The hypotheses tested included the availability of IT infrastructure, government initiatives, a stable political environment, and socioeconomic challenges as influencers of cloud computing adoption. Contrary to expectations, the regression analysis did not support these hypotheses. Additionally, an unexpected finding emerged: electricity supply exhibited a significant but negative influence on cloud computing adoption, challenging the initial hypothesis of a positive relationship.

5.3 Discussion of key findings

5.3.1 *Discussion of Hypothesis H1a: Availability of IT infrastructure (II) positively influences the adoption of cloud computing (CA)*

Contrary to the expectations of H1a, the availability of IT infrastructure does not appear to significantly influence the adoption of cloud computing. This finding contrasts with the work of Vu et al (2020), who posited that robust IT infrastructure is a key enabler of cloud computing adoption. Their study highlights how a well-established IT infrastructure facilitates cloud adoption by providing the necessary

technical foundation. In contrast, the lack of significance in this study suggests that, within the context of SMMEs in Gauteng townships, other factors might overshadow the impact of IT infrastructure, possibly due to variations in infrastructure quality or other local constraints.

5.3.2 *Discussion of Hypothesis H1b: Stable electricity supply (EL) positively influence the adoption of cloud computing (CA)*

The negative coefficient for stable electricity supply is unexpected, as H1b posits a positive influence on cloud computing adoption. This finding diverges from Kshetri (2010), who emphasised that reliable electricity is crucial for cloud computing, as it ensures consistent access to cloud services. The negative relationship observed might indicate that perceptions of stability in electricity supply could correlate with complacency or a lack of urgency in adopting cloud technologies. It could also reflect that in Gauteng townships, issues related to electricity might be more complex than a simple availability metric, such as fluctuations or reliability that affect perceptions differently.

5.3.3 *Discussion of Hypothesis H1c: Government initiatives (GI) positively influence the adoption of cloud computing (CA)*

The lack of significance for government initiatives is contrary to previous research by Alhorr et al. (2019), which found that government support plays a critical role in fostering cloud adoption. Their study highlights the positive impact of targeted policies and incentives on technology adoption. The current finding suggests that government initiatives in Gauteng townships might not be effectively aligned with the needs of SMMEs or may lack adequate implementation and visibility. This disconnect could imply a need for more tailored and actively promoted government programs to enhance their impact on cloud adoption.

5.3.4 *Discussion of Hypothesis H1d: Socioeconomic challenges (SE) negatively influence the adoption of cloud computing (CA)*

The result shows that socioeconomic challenges do not significantly impact cloud computing adoption, which contrasts with the research by Alghushami et al.

(2020), who argued that socioeconomic factors are significant barriers to cloud adoption. Alghushami et al. (2020) found that socioeconomic constraints such as financial limitations and lack of resources directly affect technology adoption. The insignificance in this study may suggest that socioeconomic challenges are not uniformly felt or might be mitigated by other factors in the specific context of Gauteng townships.

5.3.5 *Discussion of Hypothesis H1e: Political challenges (PO) negatively influence the adoption of cloud computing (CA)*

The lack of a significant relationship between political challenges and cloud computing adoption contradicts findings from Skafi et al. (2020), who identified political and regulatory environments as significant factors influencing technology adoption. Skafi et al. (2020) emphasised how political stability and supportive regulations facilitate technology adoption. The current study's finding could imply that political challenges in Gauteng townships may not be as impactful on cloud adoption as other contextual factors, or that political issues might not be perceived as barriers by the respondents.

5.4 Summary of the chapter

The findings of this study provided valuable insights into the factors influencing cloud computing adoption among SMMEs in Gauteng townships. The analysis revealed that while traditional factors such as IT infrastructure and government initiatives did not significantly impact adoption, the results highlighted the nuanced role of stable electricity supply, which exhibited an unexpected negative relationship with cloud adoption. These findings challenge conventional assumptions and underscore the complexity of the adoption process in this context. The lack of significant effects from socioeconomic and political challenges further emphasises the need for a more tailored approach to understanding and facilitating cloud adoption. Overall, this study contributes to the body of knowledge by highlighting the importance of context-specific factors and calls for further research to explore the intricate dynamics at play in similar environments.

6. CONCLUSION

6.1 Overview of the Research

This study explored the contextual factors influencing the adoption of cloud computing by small, medium, and micro enterprises in Gauteng townships, in South Africa. The research aimed to identify the extent to which factors such as IT infrastructure, stable electricity supply, government initiatives, socioeconomic challenges, and political challenges impact cloud computing adoption among these enterprises. By addressing these factors, the study sought to fill the gap in understanding the unique challenges faced by SMMEs in township settings, contributing to both theoretical knowledge and practical solutions.

6.2 Summary of Key Findings

6.2.1 *IT Infrastructure*

The availability of IT infrastructure did not have a statistically significant impact on the adoption of cloud computing among SMMEs in Gauteng townships. This finding contrasts with the broader literature that typically highlights IT infrastructure as a crucial enabler for technology adoption. This suggests that while infrastructure is necessary, other contextual factors might play a more significant role in these settings.

6.2.2 *Stable Electricity Supply*

Surprisingly, the study found a significant but negative relationship between stable electricity supply and cloud computing adoption. This result implies that even when electricity is stable, other factors may deter the adoption of cloud computing, such as costs or a lack of perceived necessity. This highlights the complexity of adoption decisions in environments with varying levels of resource availability.

6.2.3 *Government Initiatives*

Government initiatives aimed at supporting cloud computing adoption did not show a significant impact. This suggests that existing policies may not be effectively aligned with the needs of SMMEs in Gauteng townships, or that these initiatives are not reaching their intended audience effectively.

6.2.4 *Socioeconomic Challenges*

Socioeconomic challenges, including poverty, unemployment, and crime, did not significantly influence the adoption of cloud computing. This finding challenges the assumption that socioeconomic conditions are primary barriers to technology adoption, suggesting that other factors may mitigate their impact.

6.2.5 *Political Challenges*

Similarly, political challenges did not have a significant effect on cloud computing adoption. This suggests that in the context of Gauteng townships, political factors may not be perceived as major barriers, or that businesses have adapted to the existing political environment.

6.3 Addressing the Research Question

The research question guiding this study was: "To what extent do contextual factors influence the adoption of cloud computing technology in SMMEs located in the townships of Gauteng Province, South Africa?"

The study revealed that while certain contextual factors, such as IT infrastructure and government initiatives, are traditionally considered crucial for technology adoption, they did not significantly influence cloud computing adoption among SMMEs in Gauteng townships. Conversely, the negative impact of a stable electricity supply suggests that the decision to adopt cloud computing is more complex and influenced by a combination of factors unique to the local context.

This finding underscores the importance of understanding the specific needs and challenges of SMMEs in township settings, where traditional assumptions about technology adoption may not fully apply. The study highlights the need for a more

tailored approach to promoting cloud computing adoption, taking into account the unique socioeconomic and infrastructural conditions of these areas.

6.4 Implications

6.4.1 *Theoretical Implications*

The study challenges existing technology adoption models by demonstrating that in certain contexts, such as township SMMEs, traditional enablers like IT infrastructure and government initiatives may not be as influential. This calls for a revision of existing models to incorporate more context-specific factors that better reflect the realities of under-resourced environments.

6.4.2 *Practical Implications*

For practitioners and policymakers, the findings suggest that more targeted and contextually relevant strategies are needed to promote cloud computing adoption among SMMEs in Gauteng townships. This could involve more effective communication of the benefits of cloud computing, addressing the specific barriers perceived by these businesses, and ensuring that government initiatives are accessible and relevant to their needs.

6.4.3 *Policy Implications*

Policymakers should reconsider their approach to supporting cloud computing adoption among SMMEs. This might involve tailoring initiatives more closely to the local context, ensuring that infrastructure improvements go hand-in-hand with efforts to raise awareness and reduce perceived barriers.

6.5 Limitations of the study

This study, while providing valuable insights into the factors influencing cloud computing adoption among SMMEs in Gauteng townships, is not without its limitations.

Firstly, the study's geographic focus on Gauteng townships limits the generalisability of the findings. The unique socioeconomic and infrastructural

conditions in these areas may not be representative of other regions in South Africa or beyond. As such, the conclusions drawn may not fully reflect the experiences of SMMEs in different geographic or economic contexts.

Secondly, the sample size, although adequate for the scope of this research, was limited. The study's reliance on a specific number of respondents from selected townships may not capture the full diversity of perspectives among SMMEs. A larger and more diverse sample could potentially offer a more comprehensive view and enhance the robustness of the findings.

Moreover, the study focused primarily on the perceptions and self-reported experiences of the participants. This approach may introduce biases, as respondents might overestimate or underestimate the impact of various factors influencing their cloud computing adoption. Triangulating these findings with objective data or case studies could provide a more balanced perspective.

Another limitation is the cross-sectional nature of the study. Data was collected at a single point in time, which limits the ability to assess changes or trends in cloud computing adoption over time. Longitudinal studies could offer deeper insights into how adoption patterns evolve and how contextual factors may change.

Finally, the research did not explore the impact of emerging technologies or future trends on cloud computing adoption. Given the rapid pace of technological advancement, factors influencing adoption may shift as new technologies and innovations emerge. Future research should consider these dynamic elements to provide a more forward-looking analysis.

These limitations highlight the need for further research to validate and extend these findings. Addressing these limitations in future studies will help build a more nuanced and comprehensive understanding of the factors affecting cloud computing adoption in diverse contexts.

6.6 Recommendations for future research

Future research should seek to address the limitations identified in this study and further explore the complexities of cloud computing adoption among SMMEs. One key area for future investigation is expanding the geographic scope of the research. While this study focused on Gauteng townships, similar studies conducted in different regions of South Africa or other countries could provide a broader understanding of how regional factors influence cloud computing adoption. Comparative studies across various geographic and economic contexts could uncover unique challenges and opportunities faced by SMMEs in diverse settings.

Another recommendation is to increase the sample size and diversity of respondents. Future research should aim to include a larger and more varied sample of SMMEs to enhance the generalisability of the findings. Including businesses of different sizes, industries, and stages of development will provide a more comprehensive view of the factors influencing cloud computing adoption. This approach could also help identify specific needs and barriers faced by different types of SMMEs.

In addition, longitudinal studies could offer valuable insights into the dynamics of cloud computing adoption over time. Tracking changes in adoption patterns, technological advancements, and evolving business needs can provide a deeper understanding of how SMMEs adapt to cloud computing and the impact of emerging trends. This temporal perspective would help in identifying long-term factors influencing adoption and in predicting future trends.

Future research should also consider incorporating a mixed-methods approach. Combining quantitative surveys with qualitative interviews or case studies could enrich the data and provide a more nuanced view of the barriers and enablers of cloud computing adoption. This approach would allow for a more detailed exploration of the experiences and perceptions of SMME owners and managers.

Lastly, examining the role of emerging technologies and innovations in shaping cloud computing adoption is crucial. As the technology landscape evolves, new solutions and trends may alter the factors influencing cloud computing adoption. Research that explores the impact of advancements such as artificial intelligence, machine learning, and advanced cybersecurity measures on cloud computing could offer valuable insights into future adoption trends and best practices.

By addressing these recommendations, future research can build on the findings of this study and contribute to a more comprehensive understanding of cloud computing adoption among SMMEs. This will ultimately help in developing targeted strategies and interventions to support the successful integration of cloud technologies in diverse business environments.

6.7 Conclusion

This study provides valuable insights into the factors influencing cloud computing adoption among SMMEs in Gauteng townships. The findings challenge traditional assumptions and highlight the need for more context-sensitive approaches to understanding and facilitating technology adoption. By addressing the specific needs and conditions of SMMEs in township environments, stakeholders can better support these businesses in leveraging cloud computing technologies to enhance their operations and contribute to broader economic development.

7. ACKNOWLEDGEMENTS

7.1 Competing interests

The author declares that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

7.2 Author contributions

M.M. constructed the research as part of his masters degree and therefore wrote the concept paper. J.M.G. was the supervisor of the study and assisted in the writing of the final article.

7.3 Funding information

The author received no financial support for the research, authorship, and/or publication of this article.

7.4 Data availability

The data that support the findings of this study are available from the University of the Witwatersrand. Restrictions apply to the availability of these data, which were used under licence for this study.

7.5 Disclaimer

The views and opinions expressed in this article are those of the author(s) and are the product of professional research. It does not necessarily reflect the official policy or position of any affiliated institution, funder, agency, or that of the publisher. The author(s) are responsible for this article's results, findings, and content.

REFERENCES

Abaidoo, K., & Blankenberger, B. (2022). Lean and Public Organization Performance: The Wisconsin Lean Government Initiative at the Wisconsin Department of Health Services. *Public Performance and Management Review*, *45*(3), 706–736. https://doi.org/10.1080/15309576.2022.2040038

Abedian, I., Coovadia, C., Davel, G., Madungandaba, J., Masilela, E., & Rees, S. (2001). SMEs' Access to Finance in South Africa, A Supply-Side Regulatory Review, The Task Group of the policy Board for Financial Services and Regulation. *Financial Services and Regulations*.

Adejuwon, K. D. (2018). Internet of Things and Smart City Development: Is Nigeria Leveraging on Emerging Technologies To Improve Efficiency in Public Service Delivery? *Journal of Public Administration, Finance & Law*, *13*, 7–20. https://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=132352462&site=ehost-live

Ahmed, I. (2020). Technology organization environment framework in cloud computing. *Telkomnika (Telecommunication Computing Electronics and Control)*, *18*(2), 716–725. https://doi.org/10.12928/TELKOMNIKA.v18i2.13871

Alasady, A. S., Hashim, H. S., & Awadh, W. A. (2023). Nexus between Iraqi SMEs cloud computing adoption intention and firm performance: moderating role of risk factors. *Indonesian Journal of Electrical Engineering and Computer Science*, *31*(2), 1128–1135. https://doi.org/10.11591/ijeecs.v31.i2.pp1128-1135

Alghushami, A. H., Zakaria, N. H., & Aji, Z. M. (2020). Factors influencing cloud computing adoption in higher education institutions of least developed countries: Evidence from Republic of Yemen. *Applied Sciences (Switzerland)*, *10*(22), 1–27. https://doi.org/10.3390/app10228098

Ali Al-Nassar, B., Nawaf Al-Nsour, S., & Ali Rababah, K. (2021). Advantages and Factors Affecting the Adoption of Cloud Computing. *ACM International Conference Proceeding Series*, 53–56. https://doi.org/10.1145/3512716.3512726

Ali, O., Shrestha, A., Osmanaj, V., & Muhammed, S. (2021). Cloud computing technology adoption: an evaluation of key factors in local governments. *Information Technology and People*, *34*(2), 666–703. https://doi.org/10.1108/ITP-03-2019-0119

Alipour, J., Mehdipour, Y., Karimi, A., & Sharifian, R. (2021). Affecting factors of cloud computing adoption in public hospitals affiliated with Zahedan University of Medical Sciences: A cross-sectional study in the Southeast of Iran. *Digital Health*, *7*. https://doi.org/10.1177/20552076211033428

Alismaili, S. Z., Li, M., Shen, J., Huang, P., He, Q., & Zhan, W. (2020). Organisational-level assessment of cloud computing adoption: Evidence

from the Australian SMEs. *Journal of Global Information Management*, *28*(2), 73–89. https://doi.org/10.4018/JGIM.2020040104

Alsafi, T., & Fan, I.-S. (2020). Investigation of Cloud Computing Barriers: A Case Study in Saudi Arabian SMEs. *Journal of Information Systems Engineering and Management*, *5*(4), em0129. https://doi.org/10.29333/jisem/8534

Alshirah, M. H., Lutfi, A., Alshira'h, A. F., Saad, M., Ibrahim, N. M. E. S., & Mohammed, F. M. (2021). Influences of the environmental factors on the intention to adopt cloud based accounting information system among SMEs in Jordan. *Accounting*, *7*(3), 645–654. https://doi.org/10.5267/j.ac.2020.12.013

Ambrose, W., & Dagland, N. (2010). *Cloud Computing: Security Risk, SLA and Trust*. *June*, 79.

Amron, M. T., Ibrahim, R., Abu Bakar, N. A., & Chuprat, S. (2019). Determining factors influencing the acceptance of cloud computing implementation. *Procedia Computer Science*, *161*, 1055–1063. https://doi.org/10.1016/j.procs.2019.11.216

Amron, M. T., Ibrahim, R., & Chuprat, S. (2017). A Review on Cloud Computing Acceptance Factors. *Procedia Computer Science*, *124*, 639–646. https://doi.org/10.1016/j.procs.2017.12.200

Anlimachie, M. A., & Avoada, C. (2020). Socio-economic impact of closing the rural-urban gap in pre-tertiary education in Ghana: context and strategies. *International Journal of Educational Development*, *77*. https://doi.org/10.1016/j.ijedudev.2020.102236

Assante, D., Castro, M., Hamburg, I., & Martin, S. (2016). The Use of Cloud Computing in SMEs. *Procedia Computer Science*, *83*, 1207–1212. https://doi.org/10.1016/j.procs.2016.04.250

Avram, M. G. (2014). Advantages and Challenges of Adopting Cloud Computing from an Enterprise Perspective. *Procedia Technology*, *12*, 529–534. https://doi.org/10.1016/j.protcy.2013.12.525

Barzilai-Nahon, K., Gomez, R., & Ambikar, R. (2009). Conceptualizing a contextual measurement for digital divide/s: Using an integrated narrative. *Handbook of Research on Overcoming Digital Divides: Constructing an Equitable and Competitive Information Society*, *May*, 630–644. https://doi.org/10.4018/978-1-60566-699-0.ch034

Brill, J. E. (2013). Encyclopedia of Survey Research Methods. *Encyclopedia of Survey Research Methods*, 428–430.

Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.

Bvuma, S., & Marnewick, C. (2020a). An information and communication technology adoption framework for small, medium and micro-enterprises operating in townships South Africa. *Southern African Journal of Entrepreneurship and Small Business Management*, *12*(1), 1–12.

https://doi.org/10.4102/sajesbm.v12i1.318

Bvuma, S., & Marnewick, C. (2020b). Sustainable livelihoods of township small, medium and micro enterprises towards growth and development. *Sustainability (Switzerland)*, *12*(8). https://doi.org/10.3390/SU12083149

Chakraborty, A., Kumar, M., Chaurasia, N., & Gill, S. S. (2023). Journey from cloud of things to fog of things: Survey, new trends, and research directions. *Software - Practice and Experience*, *53*(2), 496–551. https://doi.org/10.1002/spe.3157

Chiza, A. B. L. (2018). Adoption of cloud computing services amongst the micro-enterprise sector in Cape Town. *Doctoral Dissertation, Cape Peninsula University of Technology*, *November*. https://www.semanticscholar.org/paper/Adoption-of-cloud-computing-services-amongst-the-in-Chiza/308f2440048300c3b6f2def498d9428e8179671b

Chutani, S., Aalami, J. R., & Badshah, A. (2010). Technology at the margins how it meets the needs of emerging markets. *Technology at the Margins: How IT Meets the Needs of Emerging Markets*, 1–166. https://doi.org/10.1002/9781119200420

Coleman, J. S. (1969). Equality of educational opportunity, reexamined. *Socio-Economic Planning Sciences*, *2*(2–4), 347–354. https://doi.org/10.1016/0038-0121(69)90029-9

Coles, E., Wells, M., Maxwell, M., Harris, F. M., Anderson, J., Gray, N. M., Milner, G., & MacGillivray, S. (2017). The influence of contextual factors on healthcare quality improvement initiatives: What works, for whom and in what setting? Protocol for a realist review. *Systematic Reviews*.

Conz, E., Denicolai, S., & Zucchella, A. (2017). The resilience strategies of SMEs in mature clusters. *Journal of Enterprising Communities*, *11*(1), 186–210. https://doi.org/10.1108/JEC-02-2015-0015

Cooper, D. R., & Schindler, P. (2011). *Business research methods*. McGraw-Hill.

Creswell, J. ., & Creswell, J. . (2018). *Research design: Qualitative, quantitative and mixed research methods approach* (5th ed.). SAGE Publications.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly: Management Information Systems*, *13*(3), 319–339. https://doi.org/10.2307/249008

Doherty, E., Carcary, M., & Conway, G. (2015). Migrating to the cloud examining the drivers and barriers to adoption of cloud computing by smes in ireland: An exploratory study. *Journal of Small Business and Enterprise Development*, *22*(3), 512–527. https://doi.org/10.1108/JSBED-05-2013-0069

Dufrasne, B., Kinney, N., Mathisen, D., Moore, C., Oscheka, M., Wohlfarth, R., & Zhang, E. (2015). *Deploying IBM Spectrum Accelerate on Cloud*.

Edwards, J. R., & Bagozzi, R. P. (2000). On the nature and direction of relationships between constructs and measures. *Psychological Methods*, *5*(2), 155–174. https://doi.org/10.1037/1082-989X.5.2.155

Effiong, A. (2020). Small-to-medium-size enterprise managers' experiences with cloud computing. *Dissertation Abstracts International Section A: Humanities and Social Sciences*, *81*(10-A), No-Specified. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=psyc17&NEWS=N&AN=2020-31772-164

Field, A. (2013). Discovering statistics using IBM SPSS statistics. In *Statistics* (Vol. 58).

Finscope. (2021). *Virtual Launch of FinScope: MSME South Africa 2020 Results*. *July*.

Fuller, W. A. (2011). Sampling Statistics. *Sampling Statistics*, 1–456. https://doi.org/10.1002/9780470523551

Garfinkel, S. L. (2011, October 3). *The Cloud Imperative | MIT Technology Review*. MIT Technology Review. https://www.technologyreview.com/2011/10/03/190237/the-cloud-imperative/

George, D., & Mallery, P. (2020). Reliability Analysis. In *IBM SPSS Statistics 25 Step by Step*. https://doi.org/10.4324/9781351033909-25

Guo, R., Tafti, A., & Subramanyam, R. (2023). Internal IT modularity, firm size, and adoption of cloud computing. *Electronic Commerce Research*. https://doi.org/10.1007/s10660-023-09691-8

Gupta, P., Seetharaman, A., & Raj, J. R. (2013). The usage and adoption of cloud computing by small and medium businesses. *International Journal of Information Management*, *33*(5), 861–874. https://doi.org/10.1016/j.ijinfomgt.2013.07.001

Gustafson, B., & Orrgren, A. (2012). *Cloud Computing: The Adoption of Cloud Computing for Small and Medium Enterprises*. 1–63.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.). Pearson New International Edition.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(July 2012), 1–55.

Iqbal, M., & Zahidie, A. (2022). Diffusion of innovations: a guiding framework for public health. *Scandinavian Journal of Public Health*, *50*(5), 533–537. https://doi.org/10.1177/14034948211014104

Julian, C. C., Mohamad, O., Ahmed, Z. U., & Sefnedi, S. (2014). The market orientation-performance relationship: The empirical link in export ventures.

Thunderbird International Business Review, *56*(1), 97–110. https://doi.org/10.1002/tie.21598

Kaiser, H. F., & Ford, H. (1984). An index of factorial simplicity. *Psychometrika*, *39*(1), 31–36.

Khayer, A., Jahan, N., Hossain, M. N., & Hossain, M. Y. (2021). The adoption of cloud computing in small and medium enterprises: a developing country perspective. *VINE Journal of Information and Knowledge Management Systems*, *51*(1), 64–91. https://doi.org/10.1108/VJIKMS-05-2019-0064

Kline, R. B. (2016). *Principles and Practice of Structural Equation Modeling* (4th (ed.)). The Guilford Press. https://www.researchgate.net/publication/235932894_Principles_And_Practice_Of_Structural_Equation_Modeling

Kshetri, N. (2010). Cloud computing in developing economies. *Computer*, *43*(10), 47–55. https://doi.org/10.1109/MC.2010.212

Kubone, S. (2018). *Role of supporting and stimulating the township economy and informal sector in the Gauteng townships*. *May*, 1–126.

Kumar, H. K., Naveen, B. R., & Savitha, J. (2022). Business Factors Challenging SMEs for Adopting Cloud-Based Solutions. *International Journal of Global Business and Competitiveness*, *17*(2), 203–214. https://doi.org/10.1007/s42943-022-00058-8

Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The Technology Acceptance Model : Past, Present, and Future. *Communications of the Association for Information Systems*, *12*(December).

Lerato, S. (2023). *Research in Business & Social Science The sustainability of township tourism SMMEs*. *12*(1), 341–349.

Lewin, K. (1952). Field Theory in Social Science. *The British Journal of Sociology*, *3*(4), 371. https://doi.org/10.2307/586914

MacVaugh, J., & Schiavone, F. (2010). Limits to the diffusion of innovation: A literature review and integrative model. *European Journal of Innovation Management*, *13*(2), 197–221. https://doi.org/10.1108/14601061011040258

Malallah, H. S., Qashi, R., Abdulrahman, L. M., Omer, M. A., & Yazdeen, A. A. (2023). Performance Analysis of Enterprise Cloud Computing: A Review. *Journal of Applied Science and Technology Trends*, *4*(01), 01–12. https://doi.org/10.38094/jastt401139

Manyaka-Boshielo, S. J. (2017). Social entrepreneurship as a way of developing sustainable township economies. *HTS Teologiese Studies / Theological Studies*, *73*(4). https://doi.org/10.4102/hts.v73i4.3830

Marikyan, D., & Papagiannidis, S. (2023). Technology Acceptance Model: A review. *TheoryHub Book*, 1–17. https://open.ncl.ac.uk

Mathibe, M., Mochenje, T., & Masonta, M. T. (2021). Assessing the Effectiveness of 4IR Strategy on South African Township Economy: Smart

Township Perspective. *Mbali Conference 2021 Proceedings*, 103.

Matias, J. B., & Hernandez, A. A. (2021). Cloud Computing Adoption Intention by MSMEs in the Philippines. *Global Business Review*, *22*(3), 612–633. https://doi.org/10.1177/0972150918818262

McKenna, A. (2023, February 23). *Gauteng | province, South Africa | Britannica*. https://www.britannica.com/place/Gauteng

Mell, P., & Grance, T. (2011). The NIST-National Institute of Standards and Technology- Definition of Cloud Computing. *NIST Special Publication 800-145*, 1–3.

Modiba, F. S., & Mago, S. (2022). Policy roadmap for a sustainable informal business sector. *Development in Practice*, *32*(8), 1078–1090. https://doi.org/10.1080/09614524.2022.2083079

Modisane, P., & Jokonya, O. (2021). Evaluating the benefits of Cloud Computing in Small, Medium and Micro-sized Enterprises (SMMEs). *Procedia Computer Science*, *181*, 784–792. https://doi.org/10.1016/j.procs.2021.01.231

Mudzamba, R., van der Schyff, K., & Renaud, K. (2022a). The challenges of cloud adoption among South African small to medium enterprises: A thematic analysis. *Electronic Journal of Information Systems in Developing Countries*, *88*(6). https://doi.org/10.1002/isd2.12235

Mudzamba, R., van der Schyff, K., & Renaud, K. (2022b). The challenges of cloud adoption among South African small to medium enterprises: A thematic analysis. *Electronic Journal of Information Systems in Developing Countries*, *88*(6), 1–18. https://doi.org/10.1002/isd2.12235

Munguti, S. N., & Opiyo, E. (2018). Factors Influencing the Adoption of Cloud Computing in Software Development Companies in Kenya. *International Academic Journal of Information Systems and Technology*, *2*(1), 126–144. http://www.iajournals.org/articles/iajist_v2_i1_126_144.pdf

Nosheen, A., & Omar, M. A. (2023). The Moderating Role of Organizational Support and Government Initiatives for CC-SaaS Adoption: A Conceptual Model for SMEs in Pakistan. *Borneo International Journal EISSN*, *6*(3), 31–38. www.majmuah.com

Oladele, O. T., Haroon-Sulyman, S. O., & Afolayan, D. . (2021). Factors Affecting the Adoption of Cloud Computing by Small and Medium-sized Enterprises (SMEs). *JoST*, *11*(2), 137–144.

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information and Management*, *51*(5), 497–510. https://doi.org/10.1016/j.im.2014.03.006

Pallant, J. (2020). *SPSS survival manual: A step-by-step guide to data analysis using IBM SPSS* (7th ed.). McGraw-Hill Education.

Park, E., & Kim, K. J. (2014). An integrated adoption model of mobile cloud

services: Exploration of key determinants and extension of technology acceptance model. *Telematics and Informatics*, *31*(3), 376–385. https://doi.org/10.1016/j.tele.2013.11.008

National Small Business Act, No 102 of 1996., 102 1 (1996) (testimony of Republic of South Africa). https://www.gov.za/documents/national-small-business-act

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Rogerson, C. M. (2001). Growing the SMME Manufacturing Economy of South Africa: Evidence from Gauteng Province. *Journal of Contemporary African Studies*, *19*(2), 267–291. https://doi.org/10.1080/02589000120066498

Rogerson, C. M. (2019). *The Economic Development of South Africa's Townships*. 187–194. https://doi.org/10.1007/978-3-319-94974-1_20

Sadoughi, F., Ali, O., & Erfannia, L. (2020). Evaluating the factors that influence cloud technology adoption—comparative case analysis of health and non-health sectors: A systematic review. *Health Informatics Journal*, *26*(2), 1363–1391. https://doi.org/10.1177/1460458219879340

Salam, N. R. A., & Ali, S. (2020). Determining Factors of Cloud Computing Adoption: A Study of Indonesian Local Government Employees. *Journal of Accounting and Investment*, *21*(2). https://doi.org/10.18196/jai.2102151

Salimon, M. G., Kareem, O., Mokhtar, S. S. M., Aliyu, O. A., Bamgbade, J. A., & Adeleke, A. Q. (2023). Malaysian SMEs m-commerce adoption: TAM 3, UTAUT 2 and TOE approach. *Journal of Science and Technology Policy Management*, *14*(1), 98–126. https://doi.org/10.1108/JSTPM-06-2019-0060

Saratchandra, M., & Shrestha, A. (2022). The role of cloud computing in knowledge management for small and medium enterprises: a systematic literature review. *Journal of Knowledge Management*, *26*(10), 2668–2698. https://doi.org/10.1108/JKM-06-2021-0421

Saunders, M., Lewis, P., & Thornhill, A. (2016). Research Method for Business Students. *Pearson Education Limited*, 768.

Sayginer, C., & Ercan, T. (2021). Critical Factors Affecting Cloud Computing Adoption in Turkish Companies With Diffusion of Innovation Theory. *Pamukkale University Journal of Social Sciences Institute*, 37–39. https://doi.org/10.30794/pausbed.750829

Sengkhyavong, W. (2019). *Factors Relating to The Adoption of Cloud Computing by IT Managers: A Correlational Study*. *June*, 136. http://search.proquest.com/openview/a8b5d7042decf69e70961efacc2f3073/1?pq-origsite=gscholar&cbl=18750&diss=y

Shetty, J. P., & Panda, R. (2021). An overview of cloud computing in SMEs. *Journal of Global Entrepreneurship Research*, *11*(1), 175–188. https://doi.org/10.1007/s40497-021-00273-2

Shoniwa, R. T. (2021). *Developing a Framework for Adoption of Cloud Computing By Small Medium Enterprises*. *May*.

Shrestha, N. (2021). Factor Analysis as a Tool for Survey Analysis. In *American Journal of Applied Mathematics and Statistics* (Vol. 9, Issue 1). https://doi.org/10.12691/ajams-9-1-2

Singh, J., & Mansotra, V. (2019). Factors affecting cloud computing adoption in the Indian school education system. *Education and Information Technologies*, *24*(4), 2453–2475. https://doi.org/10.1007/s10639-019-09878-3

Sithole, S. S., & Ruhode, E. (2021). Dedication Cloud computing adoption: challenges and opportunities for small, medium and micro enterprises in South Africa. *Proceedings of the 1st Virtual Conference on Implications of Information and Digital Technologies for Development*, 282–301.

Skafi, M., Yunis, M. M., & Zekri, A. (2020). Factors Influencing SMEs' Adoption of Cloud Computing Services in Lebanon: An Empirical Analysis Using TOE and Contextual Theory. *IEEE Access*, *8*, 79169–79181. https://doi.org/10.1109/ACCESS.2020.2987331

Stieninger, M., Nedbal, D., Wetzlinger, W., Wagner, G., & Erskine, M. A. (2018). Factors influencing the organizational adoption of cloud computing: A survey among cloud workers. *International Journal of Information Systems and Project Management*, *6*(1), 5–23. https://doi.org/10.12821/ijispm060101

Tabachnick, B. G., & Fidell, L. S. (2017). Using Multivariate Statistics؟. In *Journal of Applied Psychology* (Vol. 87, Issue 4). https://www.vlebooks.com/Vleweb/Product/Index/437320?page=0

Tobergte, D. R., & Curtis, S. (2013). Analyzing the Use of UTAUT Model in Explaining an Online Behavior: Internet Banking Adoption. *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699.

Tongsuksai, S., Mathrani, S., & Weerasinghe, K. (2023). Influential Characteristics and Benefits of Cloud ERP Adoption in New Zealand SMEs: A Vendors' Perspective. *IEEE Access*, *11*, 23956–23979. https://doi.org/10.1109/ACCESS.2023.3254500

Tornatzky, L. ., Lexington, M. ., & Fleischer, M. (1990). Technological Innovation as a Process. *The Processes of Technological Innovation*, 27–50. https://www.researchgate.net/publication/291824703

Tornatzky, L. G., & Fleischer, M. (1990). The process of technology innovation. *Technological Innovation*, *January*, 33–62.

Udo, W. S., Ochuba, N. A., Akinrinola, O., & Ololade, Y. J. (2024). Conceptualizing emerging technologies and ICT adoption: Trends and challenges in Africa-US contexts. *World Journal of Advanced Research and Reviews*, *21*(3), 1676–1683. https://doi.org/10.30574/wjarr.2024.21.3.0872

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, *39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly: Management Information Systems*, *27*(3), 425–478. https://doi.org/10.2307/30036540

Vinoth, S., Vemula, H. L., Haralayya, B., Mamgain, P., Hasan, M. F., & Naved, M. (2022). Application of cloud computing in banking and e-commerce and related security threats. *Materials Today: Proceedings*, *51*, 2172–2175. https://doi.org/10.1016/j.matpr.2021.11.121

Vu, K., Hartley, K., & Kankanhalli, A. (2020). Predictors of cloud computing adoption: A cross-country study. *Telematics and Informatics*, *52*. https://doi.org/10.1016/j.tele.2020.101426

Vygotsky, L. S. (1978). *Mind in Society: Development of Higher Psychological Processes*. Harvard University Press. https://doi.org/https://doi.org/10.2307/j.ctvjf9vz4

Widyastuti, D., & Irwansyah, M. (2018). *Benefits And Challenges Of Cloud Computing Technology Adoption In Small And Medium Enterprises (SMEs)*. *41*, 241–246. https://doi.org/10.2991/bcm-17.2018.46

Wiid, J. A., & Cant, M. C. (2021). Obstacles faced by owners of township micro, small and medium enterprises to acquire funds for survival and growth (2010-2020). *Entrepreneurship and Sustainability Issues*, *9*(1), 52–65. https://doi.org/10.9770/jesi.2021.9.1(4)

Zhang, G., Wang, W., & Liang, Y. (2021). Understanding the complex adoption behavior of cloud services by SMEs based on complexity theory: A fuzzy sets qualitative comparative analysis (fsqca). *Complexity*, *2021*. https://doi.org/10.1155/2021/5591446

APPENDIX A: Research Instrument

1. Please choose the option that best describes the location of your business **(choose only one option)**:

☐ City of Johannesburg
☐ City of Ekurhuleni
☐ Rand West City
☐ Midvaal
☐ Lesedi
☐ City of Tshwane
☐ Mogale City
☐ Merafong City
☐ Emfuleni

2. How many employees does your company employ? **(choose only one option)**

☐ 1-5 Employees: Small company
☐ 5-20 Employees: Medium company
☐ 21-50 Employees: Large Company
☐ 50-200 Employees: Large Company

3. What is the company's annual turnover? **(choose only one option)**

☐ R0 – R150 000
☐ R150 001 – R500 000
☐ R500 001 – R 25 000 000
☐ R25 000 000 – R50 000 000

4. Which sector is your company operating in? **(multiple answers are applicable)**

☐ Accommodation and Food Services
☐ Administrative and Support, Waste Management and Remediation Services
☐ Agriculture, forestry, fishing and hunting
☐ Arts, Entertainment and Recreation
☐ Construction
☐ Educational Services
☐ Finance and Insurance
☐ health care and Social Assistance
☐ Information
☐ Management of Companies and Enterprises
☐ Manufacturing
☐ Mining, Quarrying, and Oil and Gas Extraction
☐ Professional, Scientific and Technical Services
☐ Public Administration

☐ Real Estate, Rental and Leasing
☐ Retail Trade
☐ Transportation and Warehousing
☐ Utilities
☐ Wholesale Trade
☐ Other Services (Except Public Administration)

5. For how many years is your company operating in this industry? **(choose only one option)**

☐ Less than one year
☐ 1 to 3 years
☐ 4 to 6 years
☐ 7 to 10 years
☐ More than 11 years

6. Are you personally involved in IT decision-making process within your organization? **(choose only one option)**

☐ Yes
☐ No

7. Please choose the option that best describes your knowledge about cloud computing **(choose only one option)**:

☐ I have no information and knowledge about cloud computing
☐ I have little information and knowledge about cloud computing
☐ I have some information and knowledge about cloud computing
☐ I have a good understanding about cloud computing
☐ I have an excellent information and knowledge about cloud computing

8. What is your main source of information about cloud computing? **(multiple answers are applicable)**:

☐ YouTube
☐ Facebook
☐ X (formerly known as Tweeter)
☐ LinkedIn
☐ Business Contact
☐ Cloud Providers
☐ Other types of media such as TV and Newspapers

9. Is your company currently using any type of cloud computing (Software-as-a-Service, Platform-as-a-Service or Infrastructure-as-a-Service) in your business? **(choose only one option)**

☐ Yes
☐ No

10. If Yes, What type of cloud are you using? **(multiple answers are applicable)**

☐ Software-as-a-Service (SaaS)
☐ Platform-as-a-Service (PaaS)
☐ Infrastructure-as-a-Service (IaaS)

11. If you are currently using any cloud computing service, are you satisfied with the service you receive from cloud provider: **(choose only one option)**

☐ Extremely Satisfied
☐ Very Satisfied
☐ Somewhat Satisfied
☐ Very Unsatisfied
☐ Extremely Unsatisfied

For each of the questions below, circle the response that best characterises how you feel about the statement where: 1 = **Strong Disagree**, 2 = **Disagree**, 3 = **Neither Agree Nor Disagree**, 4 = **Agree**, and 5 = **Strongly Agree**.

12. Cloud adoption:

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
12.1. My business intends to adopt cloud computing in the next 12 months.	**1**	**2**	**3**	**4**	**5**
12.2. My business plans to implement cloud computing in the next 12 months.	**1**	**2**	**3**	**4**	**5**
12.3. My business intends to stop using cloud computing in the next 12 months.	**1**	**2**	**3**	**4**	**5**

13. IT infrastructure:

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
13.1.	I have reliable internet connectivity in my area for my business.	**1**	**2**	**3**	**4**	**5**
13.2.	I have access to modern computing devices (e.g., computers, laptops, smartphones) to use for my business.	**1**	**2**	**3**	**4**	**5**
13.3.	I have adequate technical support and expertise for IT infrastructure for my business.	**1**	**2**	**3**	**4**	**5**
13.4.	My business allocates enough budget for IT infrastructure (e.g., cost of internet services, hardware).	**1**	**2**	**3**	**4**	**5**

14. Electricity:

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
14.1.	I have a reliable power supply for my business.	**1**	**2**	**3**	**4**	**5**
14.2.	My business can afford to pay for electricity.	**1**	**2**	**3**	**4**	**5**
14.3.	I have additional backup power supply for my business.	**1**	**2**	**3**	**4**	**5**
14.4.	Electricity issues are resolved quickly in my business area.	**1**	**2**	**3**	**4**	**5**

15. Socioeconomic:

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
15.1.	Poverty is prevalent in my business area.	**1**	**2**	**3**	**4**	**5**
15.2.	Unemployment is prevalent in my business area.	**1**	**2**	**3**	**4**	**5**

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
15.3.	Crime is prevalent in my business area.	**1**	**2**	**3**	**4**	**5**
15.4.	Cloud computing knowledge and skills are rare in my business area.	**1**	**2**	**3**	**4**	**5**
15.5.	There is adequate support and training by cloud computing vendors in my business area.	**1**	**2**	**3**	**4**	**5**

16. Government initiatives:

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
16.1.	Government provides incentives for small businesses to adopt cloud computing technologies.	**1**	**2**	**3**	**4**	**5**
16.2.	Government creates adequate cloud computing initiatives in my business area (such as setting up the facilities to enable cloud computing).	**1**	**2**	**3**	**4**	**5**
16.3.	The country's laws and regulations are sufficient to protect the use of cloud computing.	**1**	**2**	**3**	**4**	**5**
16.4.	The country's laws and regulations facilitate the use of cloud computing.	**1**	**2**	**3**	**4**	**5**

17. Politics:

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
17.1.	The political climate in my business area supports the growth of small businesses.	**1**	**2**	**3**	**4**	**5**
17.2.	Authorities can gain unauthorised access to my	**1**	**2**	**3**	**4**	**5**

		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
	company's sensitive data if stored in the cloud.					
17.3.	Politics in my business area are stable and predictable.	**1**	**2**	**3**	**4**	**5**
17.4.	Political factors, such as taxation policies and incentives favour small businesses.	**1**	**2**	**3**	**4**	**5**

Conclusion

Thank you for participating in this survey!

APPENDIX B: Participant Information Sheet

PARTICIPANT INFORMATION SHEET

You are being asked to participate in a research study. Before you give your consent to be a volunteer, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

Researcher:

Mr. Michael Manaka
MBA Candidate in the Faculty of Commerce, Law and Management
Wits Business School
University of the Witwatersrand
Email address: 9404687m@students.wits.ac.za
Telephone: (27) 73 776 6359

Faculty Supervisor:

Dr. Jabulile Msimango-Galawe, PhD
Senior Lecturer/Programme Director: MM Business and Executive Coaching
Wits Business School
University of the Witwatersrand
Email address: jabulile.msimango-galawe@wits.ac.za
Telephone: (27) 11 717 3980

Purpose of the Study:
This project is being done, as part of the requirements, for a Master's degree. The main purpose of this study is to determine the key factors that are important for decision-makers of Small and Medium and Micro enterprises (SMMEs) when deciding whether to adopt cloud computing technology or not. This research is not industry-specific and SMMEs from various industries can participate in this study. This questionnaire should be filled out by IT decision-makers of Small, Medium and Micro-Enterprises. The target population of this study are IT decision-makers of SMEs.

Description of the Study:
You are asked to participate in a survey. This survey consists of simple and easy-to-understand questions. Some of the questions may have more than one item to be answered. We are trying to capture your opinion about cloud computing and the factors influencing your intention to adopt it. This survey will not take more than 15 minutes to complete. The answer to most of the questions is a five-point Likert scale.

Risk of discomfort:
This questionnaire takes about 15 minutes of your time. The nature of the survey may make you uncomfortable. We ask you to stop the survey, whenever you feel uncomfortable or bored. You may not wish to answer some questions. You can skip any question you wish and still complete the survey. You may also withdraw from completing the survey at any time, and your data will not be considered.

Benefits of the study:
The result of this study may be used to accelerate the diffusion of cloud computing among SMMEs. SMMEs play an important role in each economy; they have a significant contribution to each economy's Gross Domestic Product (GDP). Therefore, any kind of technology or strategy that helps SMEs, may improve the whole economy as well. Identifying the factors that are important for SMMEs, may allow cloud providers to adjust their systems based on the needs and demands of their clients (SMMEs), which is very favourable for small businesses. These are practical contributions of this study. On the other hand, the results of this study may shed some light on understanding the process of adopting cloud computing by SMMEs. These results are favourable for academia as well. Please note that we cannot guarantee any direct benefit to any individual participants.

Confidentiality:
This survey is anonymous. No personal question, other than your age group and education level will be asked.

Voluntary nature of participation:
Participation in this study is voluntary. Your choice of whether or not to participate will not influence your future relations with Wits Business School and the University of the Witwatersrand. If you decide to participate, you are free to withdraw your consent and to stop your participation at any time. At any particular point in the study, you may refuse to answer any particular question or stop participation altogether. If you feel uncomfortable or bored at any time during the survey, you can stop the survey.

Questions about the Study:
If you have any questions about this research, please feel free to contact me or my supervisor at the details listed above.
If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), by telephone at +27(0)11 717 1408, email hrecnon-medical@wits.ac.za.

APPENDIX C: Participant Consent Sheet

PARTICIPANT CONSENT SHEET

Factors that influence the adoption of cloud computing by SMMEs in Gauteng townships in South Africa.

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understood;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the study would immediately be destroyed, unless I give consent for it to be retained
7. I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study I am free to speak to any of these contacts.

Contact details:

Mr. Michael Manaka, Principal Investigator, telephone no. 073 776 6359, or by e-mail at 9404687m@students.wits.ac.za,

Dr. Jabulile Msimango-Galawe, Supervisor, on telephone no. 011 717 3980, or by e-mail at jabulile.msimango-galawe@wits.ac.za,

University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408 or by email at hrecnon-medical@wits.ac.za.

Name of Participant: _____
Date: _____
Place: _____
Signature or mark: _____

Witnessed by:
Name of Witness: _____
Signature: _____
Date: _____