The adoption of cloud-based Software as a Service (SaaS): A descriptive and empirical study of South African SMEs

RESEARCH REPORT

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ABSTRACT

The purpose of this study was to describe the state of cloud-based software (SaaS) adoption among South African SMEs and to investigate the factors affecting their adoption of SaaS solutions. The technological, organisational and environmental (TOE) factors influencing cloud-based software adoption within SMEs were identified through a review of existing TOE literature. In addition, institutional theory and diffusion of innovation theory were also used to underpin the study. A research model hypothesising the outcome of the identified TOE factors on the adoption of cloud-based software was developed and tested. Specifically, factors hypothesised to influence SaaS adoption were compatibility, security concern, top management support and coercive pressures.

This study employed a relational, quantitative research approach. A structured questionnaire was developed and administered as an online survey. Data was collected from a sample of 134 small and medium enterprises (SMEs) that provided usable responses. The collected data was used to firstly describe the state of adoption. Secondly, the extent to which various TOE factors impact on adoption was examined through the use of multiple regression. It was found that compatibility, security concern, top management support and coercive pressures influence adoption while trust, cost, relative advantage, complexity, geographic dispersion, normative and mimetic pressures did not have significant effects. This study adds value to the Information Systems literature as it uses the TOE framework alongside institutional theory and diffusion of innovation theory to explain the adoption of cloud-based software solutions by South African SMEs.

This study provides information on the current state of adoption for cloud-based software within SMEs in South Africa. Organisations can also learn about the factors contributing to this adoption. Organisations can also be informed that for adoption to be successful, technological, organisational and environmental factors must be taken into consideration. Results assist organisations wanting to implement cloud-based software solutions. Specifically, results provide a benchmark for SMEs on where their organisations stand compared to other organisations with regards to SaaS adoption (for example whether they are lagging behind, they are on par, or whether they are innovators). This could inform their IT procurement decisions, e.g. to consider whether cloud-based software solutions are strategic and necessary to keep abreast with peers and competitors.

DECLARATION

I declare that this research project is my own work; it has not been submitted before for degree at this or any other university. It is being submitted for the degree of Master of Commerce in Information Systems to the University of the Witwatersrand, Johannesburg.

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Mabuke Dorcus Maserumule

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LIST OF ABBREVIATIONS

ACT Absorptive Capacity Theory

ASP Application Service Providers

CRM Customer Relationship Management

DTI Department of Trade and Industry

DOI Diffusion of Innovation Theory

EPS Electronic Procurement System

ERP Enterprise Resource Planning

GDP Growth Development Program

IaaS Infrastructure as a Service

IFC International Finance Corporation

IS Information Systems

IT Information Technology

NIST National Institute of Standards and Technology

PaaS Platform as a Service

PCA Principal Components Analysis

PERM Perceived E-Readiness Model

RBV Resource-Based View

SaaS Software as a Service

SLA Service Level Agreement

SMEs Small and Medium Enterprises

TAM Technology Acceptance Model

TOE Technology Organisation and Environment

CHAPTER 1: INTRODUCTION

1.1 Background to Cloud Computing and SaaS

Cloud-based solutions provide an innovative way to deliver computing services (Rostami, Akbari & Javan, 2014). Cloud-based computing resources are generally accessed on a pay-per-use model where the cloud provider offers user assurances about the availability of the service by virtue of customised service level agreements (SLAs) (Vaquero, Rodero-Merino, Caceres & Lindner, 2009).

Although there is no single definition for cloud computing (Bragg, 2008; Geelan, 2008; Gruman & Knorr, 2008), cloud computing solutions are generally considered to be made up of a pool of adequately available virtualized resources such as development platforms, hardware, software, and services. More formally, cloud services have been classified into three categories (Janssen & Joha, 2011). These are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). This study focuses on SaaS. SaaS is defined as a "software delivery model in which services are installed, assembled and maintained on the systems of the SaaS provider and used by others over the internet" (Janssen & Joha, 2011, pg.4). Within a SaaS solution, the vendor takes responsibility for managing the software and for delivering it over the internet, as a service to numerous customers (Guo, 2009).

This study attempts to establish the state of SaaS adoption by SMEs in the South African context. Sultan (2010) conducted a survey demonstrating that an increasing number of small-medium enterprises (SMEs) are thinking of migrating some features of their operations to the cloud. Dubey and Wagle (2007) argue that SMEs can benefit more from SaaS adoption than large organisations. SaaS is considered a popular package among SMEs because of its potential to cut their IT-related costs and simultaneously increasing flexibility within their IT environments (Haselmann & Vossen, 2011). Generally, SMEs are considered to be benefiting most from SaaS products (Dillon & Vossen, 2014). Van de Weerd, (2016) highlight that cloud solutions are highly suitable for SMEs.

1.1.1 Small Medium Enterprises (SMEs) in South Africa

Small Medium Enterprises (SMEs) plays a vital role in South Africa economically as they contribute and add value significantly to the national Growth Development Program (GDP) with high expectations for the role they can play in job creation (The DTI, 2008). Abor and Quartey (2010) are of the view that SMEs contribute between 52 to 57% of GDP and contribute 6.1% towards employment.

There are numerous definitions for SMEs, and this study will focus on defining SMEs within the South African context. A common definition of SMEs as defined by International Finance Corporation (IFC) which highlights that SMEs are businesses registered with employees being less than 250 (IFC, 2009). Practically, SMEs are defined differently, in connection with the number of employees or the enterprise's income or even consolidation of both as stated by the National Small Business Act of 1996. This study has adapted to SMEs definition from the National Small Business Act of 1996. Specifically, SMEs are defined as firms that are officially registered, governed by one or more owners, may include multiple branches or sites and consists of less than 250 employees (National Small Business Act of 1996).

1.1.2 Software as a Service (SaaS) for SMEs

There are a large number of cloud-based software solutions (SaaS) available to SMEs. For example, one promising SaaS solution is cloud-based ERP (Lechesa, Seymour & Schuler, 2012).Cloud ERP offers benefits such as flexibility and pay as you use. A survey conducted by Forrester research in 2006 and 2007 across North America and Europe provided some insights into SaaS within SMEs and determined that popular SaaS solutions being implemented were to support customer relationship management and human resources management, along with collaboration tools (Deyo, 2008).

Other SaaS solutions are available for the Internet-based delivery of general productivity tools (e.g. Microsoft Office 365) and-; e-mail (e.g. Gmail). A comprehensive picture of the state of cloud software (SaaS) adoption by SMEs in South Africa has not been adequately researched. Moreover, an examination of a theoretically derived set of factors for their influence on adoption has not been sufficiently researched. Therefore, this study intents to establish the present state of cloud-based software solutions adoption within SMEs in South Africa. Furthermore, because SMEs are faced with the challenge of adopting or not to adopt cloud-based software solutions, this study aims to explore the factors influencing that adoption decision.

1.2 Research Problem

Cloud-based software solutions are receiving increasing attention from industry (Peng & Gala, 2014). These solutions can be of benefit (Rostami et al. 2014). One of the advantages of implementing cloud-based software is flexibility and, instead of installing and owning the software, one pays as they use (Lenart, 2011). Cloud-based software solutions also allow users to take advantage of the latest software release because upgrades happen automatically (Johanson, Alajbegovic, Alexopoulos & Desalermos, 2001). Salleh (2012) has described other factors such as implementation cost reduction,

extensibility, ease of use and the capacity to concentrate on core business activities as some of the main factors impacting cloud enterprise system adoption.

Yet there are also uncertainties and possible risks associated with adoption such as vendor-lock-in whereby enterprises are locked into the cloud provider and as a result cannot control their infrastructure and platforms (Lenart, 2011). Other barriers include lack of security (Garg & Stiller, 2014; Rostami et al. 2014). Security is treated to be an important aspect of cloud-based services as organisations share data and processes with the cloud vendor (Lal & Bharadwaj, 2016). There may also be problems with customization and integration (Burrel, 2009).

Although many vendors purport that adoption of SaaS can deliver benefits, some organisations are still hesitant to introduce SaaS (Madisha & Van Belle, 2011). The problem that organisations are faced with is weighing up the potential benefits against the challenges to decide on whether or not to adopt cloud-based software solutions. Therefore, it becomes imperative to understand the factors that come to influence the adoption decision and the current state of adoption.

1.3 Purpose of the Study

This study intends to research the extent to which South African SMEs have adopted cloud-based software solutions and explore the factors playing a vital role in their decision for adopting or not adopting cloud-based software solution. To explore the factors affecting cloud-based software solutions adoption within South African SMEs. This study draws on the Technology – Organisation – Environment (TOE) framework (Tornatsky and Fleischer, 1990), along with diffusion of innovation (DOI)-; (Rogers, 1995) and institutional theory (Di Maggio & Powell, 1983) as its theoretical lens.

The leads to the following two research questions:

RQ1. What is the current state of adoption of cloud-based software solutions (SaaS) as reported by SMEs in South Africa?

RQ2. What are the technological, organisational and environmental factors perceived to be influencing South African SMEs to adopt cloud-based software solutions (SaaS), and what are their relative effects on adoption?

1.4 Objectives of the study

To answer the research questions as mentioned-above, the objectives of this study are to determine the extent of cloud adoption and to explore factors affecting the adoption of cloud-based software solutions. This study draws on TOE, DOI and institutional theory to develop a model hypothesizing the effects of selected factors on the adoption of cloud-based software. A relational research design was employed in this study (Bhattacherjee, 2001; Shadish, Cook and Campbell, 2002). This study adopted a cross-sectional quantitative approach to get a generalised overall view of probability to

adopt cloud-based software solutions. A quantitative approach allows for an overall aggregate view of the current state of the adoption of cloud-based software solutions across a large sample of SMEs in South Africa, which is required to answer the research questions posed in this study.
A structured questionnaire instrument was developed to carry out a survey to collect data from the sampled organisations. Survey data was used to present the current state of cloud-based software adoption. The survey was administered online. The reliability and validity of the measures for the variables will be tested from the TOE, DOI and institutional theory as well as discussing the results with reference to literature.

1.5 Significance of the study

Although several studies have researched some of the factors impacting cloud-based software adoption such as cloud ERP (Salleh, 2012; Salim, 2013; Garg & Stiller, 2015), these studies have not examined the effects of a comprehensive set of factors drawn from theory.

Past studies have only recorded the factors influencing cloud enterprise system adoption and tend to forget that the adoption of cloud-based software solutions happens within organisations and therefore the environment of the organisation as well as the technology being adopted play a vital role (Salleh, 2012) This study draws on the TOE framework, DOI and institutional theory to understand factors affecting cloud-based software solutions adoption. This study thus tackles a research gap by combining three theoretical models to enhance our understanding of the factors affecting organisational adoption of cloud-based software solutions and impart knowledge regarding the current state of adoption for cloud-based software within SMEs in South Africa.

This study is also of practical importance to organisations wanting to implement cloud-based software solution as they can use the results of this study to benchmark where they stand compared to other organisations with regards to SaaS adoption. For example, it can help them evaluate whether they are lagging behind, on par, or whether they are innovators with regards to SaaS adoption. This results could inform their IT procurement decisions, for example; to consider whether cloud-based software solutions are strategic and necessary to keep abreast with peers and competitors. Results will also inform SMEs of which factors are most important for adoption and therefore constitute enabling conditions or inhibiting factors that must be considered prior to SaaS adoption. Future research directions would be to apply the proposed research model to other countries and industries.

Organisations can also learn about the factors contributing to this adoption. Organisations can also be informed that for adoption to be successful, technological, organisational and environmental factors must be taken into consideration. Results assist organisations wanting to implement cloud-based software solutions. Specifically, results provide a benchmark for SMEs on where their organisations stand compared to other organisations with regards to SaaS adoption.

1.6 Delimitations of the Study

In this study, the focus is confined to the following cloud-based software solutions (SaaS), namely; cloud ERP, cloud CRM, cloud e-mail, cloud productivity, cloud financials, cloud e-commerce, and cloud storage. The study will not examine other cloud services, which are IaaS and PaaS. The focus is on South African small-medium enterprises (SMEs) and does not consider SaaS adoption within larger companies in South Africa. Data is to be collected based on self-reports by a single key informant and does not involve observation of actual systems in place within the sampled SMEs.

1.7 Structure of the Report

This research report is structured and categorised into the following chapters:

- **Chapter 1 – Introduction**

This chapter presented the background of the study. The theories which this study draws on were identified. Furthermore, the research problem within the study was stated as well as the purpose of the research study. Finally, the significance of the study was highlighted.

- **Chapter 2 – Literature Review**

This chapter presents the history of cloud computing, examples of Software as a Service (SaaS) as well as the review of past SaaS adoption literature.

- **Chapter 3 – Theoretical Background and Research Model**

This chapter presents the theoretical background leading to the development of the research model and hypotheses. The Technology Organisation Environment (TOE) framework, institutional theory and diffusion of innovation theory are presented as the theories underpinnings this study.

- **Chapter 4 – Research Methods**

This chapter presents the research methods applied to test the research model and hypotheses. The methods used for data collection as well as the research approach followed. In addition, the construction of the research instrument is discussed followed by the strategy for pre- and pilot testing used to validate the research instrument. Lastly, the data analysis methods used to analyse and measure the validity and reliability of the research instrument are outlined. Finally, ethical considerations are also listed.

- **Chapter 5 – Research Results**

This chapter outlines the key findings of the study with respect to the state of SaaS adoption among SMEs (RQ1), and test the research model of the factors impacting SaaS adoption (RQ2).

- **Chapter 6 – Discussion**

This chapter discusses the findings of this study in respect of the research questions.

- **Chapter 7 – Conclusion**

This chapter concludes the study. The contributions of the study for both theory and practice are highlighted together with recommendations for future research.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter reviews the literature on the adoption of SaaS with the aim of establishing the existing body of knowledge on SaaS adoption more broadly, and in the South African context in particular. It first discusses the background of cloud computing as well as the definition. It then highlights past studies done on the adoption of cloud-based software. It concludes with a summary of the gap in literature leading to the study's research questions.

2.2 Background to Cloud Computing

Cloud computing concept is defined in various ways but a popular definition in literature on cloud computing is from National Institute of Standards and Technology (NIST), which defines it as "technologies that allow ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or cloud provider interaction" (Mell & Grance, 2011. Pg.2). The principle of sharing computer resources amongst a number of users historically emerged in the 1950s and 1960s (Schofield and Abrahams, 2015). That was a paradigm shift from mainframes to client-server setup (Bhardwaj, Jain&Jain, 2010). Cloud computing was developed by major information technology providers such as Amazon, Microsoft, Google and Sun in 1990 (Lui & Cai, 2013).

Early definitions defined cloud computing as internet centric software (Cohen, 2008). Subsequently, other common factors which characterise the various cloud computing definitions are pay-as-you-go, virtualization, on-demand and agility (Salleh, Teoh & Chan, 2012). For example cloud computing is referred to as an expandable and on-demand service being deployed through the internet from dedicated data centres (Arpaci, Kilicer & Bardakci, 2015). Elsewhere, cloud computing is defined as the vast batch of web-based services aiming to allow users to obtain a wide range of functional capabilities on a pay as you go method that in the past required major hardware and software investments (Martin, 2008; Kepes, 2008). The diagram below illustrates the evolution of cloud computing contrasting it with traditional computing paradigms, and newer networked paradigms.

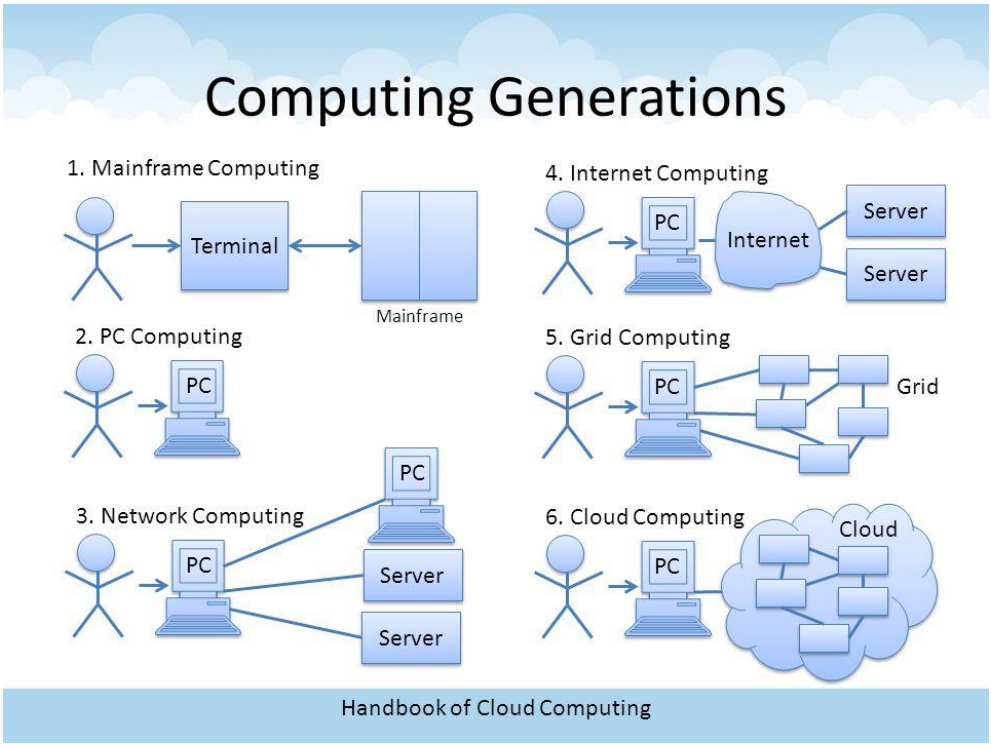

Figure 1: Cloud Computing Evolution

(Source: Cloud Computing benefits and challenges, Omara, Salem & Handosa).

(http://google.co.za/search?q=Traditional+cloud+computing+paradigms+vs+current+cloud+computing&tbm=isch).

Cloud computing differs in terms of deployment and service models which are discussed next.

2.3 Cloud Computing Deployment Models

Cloud computing deployment models are categorized into four levels, namely private cloud, public cloud, community cloud and hybrid cloud (Akande & Van Belle, 2014). Private clouds are developed and deployed to be used internally within an organisation by its users (Mohlameane & Ruxwana, 2013), and are suited more for large organisations (Gupta, Seetharaman & Raj, 2013). Within the private cloud, information security is better than the other cloud deployment models (Cloud Security Alliance, 2010). For organisations that are concerned about security, the private cloud deployment model is typically recommended. In terms of managing the infrastructure, the organisation can manage the infrastructure or ask a vendor to manage the infrastructure for them. The infrastructure can either be on premises or off premises (Akande & Van Belle, 2014). The examples include Amazon Elastic Compute Cloud (EC2), Rackspace, Web Trends On-Premises, Amazon Simple Storage Service (S3), and GoGrid (Oliveira, Thomas & Espadanal, 2014).

In the public cloud model, the resources are shared amongst cloud subscribers, and those shared resources are available over the internet (Mohlameane & Ruxwana, 2013). Ownership in public cloud lies with the vendor who is controlling the infrastructure (Akande & Van Belle, 2014; Cloud Security Alliance, 2009). NIST simplifies the distinction between the private and public cloud models by describing the latter as one that it is open to the general public. Public cloud examples are Google Apps and Amazon Web Service. In community cloud, organisations sharing similar goals, objectives and policies have a dedicated cloud infrastructure available only for themselves to use (Mohlameane & Ruxwana, 2013; Akande & Van Belle, 2014). Cloud Security Alliance explains that the community cloud infrastructure can also be managed by organisations or a third party and deployed on-premise or off-premise. (Cloud Security Alliance, 2010). Most characteristically, the cloud infrastructure within the community cloud model is shared by several organisations with similar concerns like security requirements and policies (Cloud Security Alliance, 2010). For example organisations in the media industry are looking for agile, simple solutions that will enhance the proficiency of content production and also to reduce costs and cut delays and bottlenecks in the production process (Siemens, 2010). Community cloud provides a secure and adaptable platform for the real-time exchange of file-based digital media content (Siemens, 2010).

Hybrid cloud is a combination of elements from private, public or community cloud (Mujinga &Chipangura, 2011). Organisations will progressively turn to the hybrid cloud to enable scalable business processes to be paid for when needed (Telkom Business Connexion, 2016). For example, an organisation can use a private cloud for sensitive data and a public cloud for their less sensitive data (Akande & Van Belle, 2014).

2.4 Cloud Computing Service Models

Cloud computing consists of three cloud service delivery models, and those are Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). Figure 2 depicts examples of the three types of cloud service models and Table 1 then expands on the differences between the three cloud service models. This study is focused on the adoption of SaaS, which is expanded on Section 2.4.1.

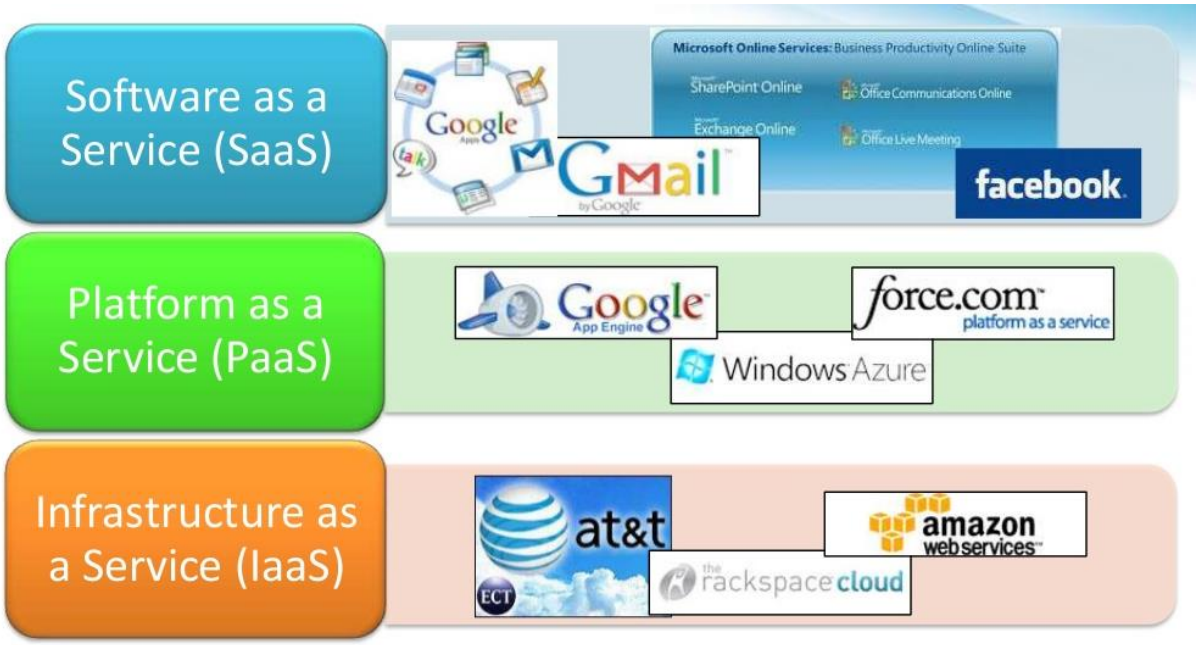

Figure 2: Cloud Service Models

(Source: Salesforce available at http://www.salesforcec2.com/2015/08/cloud-computing-service-model-types-iaas-paas-saas.html)

Service Model Type	Software as a Service(SaaS)	Platform as a Service (PaaS)	Infrastructure as a Service (IaaS)
Differences	As opposed to installing the software and updating the software's patches regularly, frequent version updates are done automatically on applications like Customer Relationship Management (CRM), Enterprise Resource Planning (ERP) accessible to end-users hosted over the internet	The platforms and software developments kits and tools (like Java, Python and .Net) are made available over the internet instead of buying software licenses for the above-mentioned platforms. Examples of those platforms are middleware and databases.	The infrastructure refers to the actual physical device like storage devices, virtual computers, servers, network transfer. These devices are physically located in one main place like data centre, but they can be acquired over the internet using a login authentication system.
Strengths	Only pay for what you use. No worries about software upgrades as they are done automatically.	No maintenance costs since there is no infrastructure, Security updates and backups.	Advantage of being on the latest technology for infrastructure equipment as well as adding more services like workload management.
Weakness	Dependence on the internet, the service will not function if there is no internet connection. Dependency on the cloud vendor. If the cloud vendor would go bankrupt, the organisation will struggle with regards to accessing their data.	Vendor lock-in, it is not possible for an organisation to switch cloud vendors, deployment to public clouds only, and Security and privacy issues. PaaS does not integrate well with any in-house applications.	Organisations cannot control their data — Lack of service management in ensuring service level agreements as well as control over policies and access.

Bhardwaj, 2010; Buyya, Vecchiola & Selvi, 2013; Rostami, Akbari & Javan, 2014. (Gupta, Seetharaman & Raj, 2013)

Table 1: Different types of Cloud Computing Service Models

2.4.1 Software as a Service (SaaS)

The history of cloud computing experienced a critical turning point in 1999 after Salesforce.com announced the concept of running applications through a web site. Although turning software into a service surfaced in the late 1990s. SaaS came into mainstream attention when Salesforce.com launched customer relationship management (CRM) SaaS in 1999 (Lechesa, Seymour & Schuler, 2012). Salesforce.com has since become the leading cloud provider of Customer Relationship Management (CRM) software services (Deyo, 2008).

SaaS examples also include cloud enterprise resource planning (ERP), cloud customer relationship management (CRM), cloud e-mail, cloud productivity, cloud financial or payroll tools, cloud e-commerce platform, cloud storage, video conferencing, IT helpdesk and, virtual team communication (Xin & Levina, 2008). The below table 2, illustrates SaaS business functions together with their examples.

Key Business Function	SaaS Example
Cloud CRM	Salesforce
Cloud ERP	NetSuite
Cloud e-commerce	Shopify
Cloud Productivity	Microsoft Office 365
Cloud storage	Dropbox, Google Drive
Cloud e-mail	Gmail

Source: adapted from http://www.gartner.com/it-glossary/cloud.

Table 2: SaaS Business Functions

Cloud ERP as a SaaS solution is capable of delivering software functionality to support key business functions (Fassen, Seymour & Schuler, 2013). One popular vendor of cloud ERP is NetSuite (Bhardwaj, Jain & Jain, 2010). Other examples of SaaS available for SMEs are Google apps and the Microsoft Office 365 SaaS solution (Mohlameane & Ruxwana, 2014). Some of the expected benefits of SaaS are flexible monthly instalments (Fassen, Seymour & Schuler, 2013) simplified operations, significant cost reduction, pay-as-you-go pricing which allows for quick roll out and return on investments, automatic updates to the software and patches occur without disrupting the organisation (St. Clair, 2008). Furthermore, SaaS may be attractive for SMEs because currently, SMEs cannot

afford expensive applications and therefore SaaS has been reported to be affordable especially on applications like Customer Relationship Management (CRM) offered by Salesforce.com as per pay use model (Gupta et al. 2013).

Another attractive SaaS component is that it permits access from any geographical location given that SMEs employees often work outside the actual office location and hence having easy access of their data using mobile devices will be a big plus for them (Gupta et al., 2013; McAfee, 2011). Therefore SaaS presented a solution to SMEs in terms of lowering the cost and offering mobility with regards to geographic location. The below figure 3, illustrates some of the different available SaaS options.

Figure 3: Different Types of SaaS Options.

Source: adapted from http://www.gartner.com/it-glossary/cloud.

SaaS has a brief history, and it is still evolving (Lee, Chae & Cho, 2013). The state of adoption of these technologies among South African SMEs is not well understood. In the next section, past studies into the adoption of cloud-based software are reviewed.

2.5 Past Research on Adoption of Cloud-based Software

To review past academic research on SaaS cloud-based software adoption, a search of a number of databases/journals was carried out, namely Science Direct, Pro Quest, Emerald, EBSCOhost, and JStor. To identify relevant articles, the search terms used included "Cloud ERP" OR "Software as a Service" OR "SaaS" OR "Cloud Software") AND (Adoption). The inclusion criteria was that the studies needed to be empirical studies and carried out at the organisational level.

To supplement the above-mentioned search strategy, date filters were used to limit the search to recent articles. Reviewing of reference list for articles that were identified was also used as well as ad-hoc search from Google Scholar. The articles that were found to be relevant to this study are reviewed in the next below table showing a summary of past research on the adoption of cloud-based software.

Study	Purpose of the study	Context	Theory	Findings
Gibbs & Kraemer (2004)	Develop and test an integrated model of the scope of e-commerce use	Organisation	DOI and Institutional Theory	Perceived strategic benefits, financial resources, technology resources and external pressures are the leading elements for organisational adoption as well as the way on how e-commerce is used within the firm's business actions.
Soares-Aguiar & Palma-Dos-Reis (2008)	Establishes factors influencing Electronic Procurement System (EPS) adoption.	Organisation	TOE and Institutional Theory	Commercial firms have higher chances of adopting EPS than firms operating in services industries or manufacturing.
Xin & Levina (2008)	Investigate client's adoption of the emerging SaaS model while making a clear distinction between SaaS and Application Service Providers (Asp) models	Organisation	Resource Based View and Institutional Theory	The maturity of the client's internal enterprise IT architecture plays an important role in SaaS adoption decisions.

Study	Purpose of the study	Context	Theory	Findings
Benlian & Hess (2011)	Provides an analysis of the benefits and risks that come with SaaS adoption as recognised by IT executives at firms that are adopting and those not adopting.	Organisation	Theory of Reasoned Action	The security risk is the dominating factor for both SaaS and adopters and non-adopters that impacts IT executive's general uncertainty impression and cost advantage being the robust driver influencing IT executive's awareness of SaaS opportunities.
Madisha & Van Belle (2011)	Investigates factors influencing organisational SaaS readiness and adoption amongst SMEs and non-profit organisations (NPOs)	Organisation	DOI and Perceived E-readiness Model (PERM)	Prevalent factors related to SaaS adoption included: awareness, security and privacy concerns, high internet costs, poor access to the internet and organisational resources. High internet costs, low internet reliability and poor access were found to be inhibitors to the adoption of SaaS.

Study	Purpose of the study	Context	Theory	Findings
Subashini & Kavitha (2011)	Presents different security risks posing a threat to the cloud environment.	Organisation	No underpinning theory	Cloud environment will remain unsafe as long as integrated security model is not developed.
Lechesa et al. (2012)	Determines barriers influencing the adoption of ERP SaaS in South Africa	Organisation	TOE	The key factor influencing the choice to adopt ERP SaaS in South Africa is the environmental factors.
Faasen et al. (2013)	Investigate unwillingness by South African SMEs to examine SaaS ERP business model	Organisation	TOE	Reluctance to adopt SaaS ERP is essentially associated with availability risk, system performance, risk on data security, lack of control and lack of trust in the vendor.

Study	Purpose of the study	Context	Theory	Findings
Akande & Van Belle (2014)	Explore the use and identify benefits and limitations of SaaS in South African higher educational institution with the intention of determining if SaaS is the feasible option for higher educational institution	Organisation	No underpinning Theory	SaaS is the feasible option for higher educational institution as installations, upgrades and maintenance of the software and applications are taken care by the vendor.
Cohen et al. (2014)	To develop and test the research model aimed at understanding organisational adoption of cloud computing.	Organisation	Absorptive capacity theory and Institutional Theory	Top management support is the most important positive factor affecting cloud computing adoption.
Li et al. (2014)	To understand and explain the role of cloud service trust in transformation process in SMEs based on technology – organisation - environment paradigm.	Organisation	DOI and Trust Theory	Cloud service trust has an important positive influence on SME's intention for adopting cloud services.

Study	Purpose of the study	Context	Theory	Findings
Rostami et al. (2014)	Analyse organisations with the goal of understanding the benefits, weakness and risk of SaaS.	Organisation	No underpinning Theory	Main SaaS benefits include permanent availability of SaaS networks and reducing the cost of using SaaS. The main weakness was found to be dependency on the internet, and the risk associated with SaaS were found to be security and lack of controlling risk associated with the problem with integrating applications
Safari et al. (2015)	Investigates the adoption of SaaS and provide a better understanding of SaaS technology adoption.	Organisation	DOI and TOE	All attributes of technology, organisational, and environmental are influential in SaaS adoption.

Study	Purpose of the study	Context	Theory	Findings
Salum & Rozan (2015)	Identifies the drivers and barriers to be considered by SMEs wanting to adopt cloud ERP	Organisation	No underpinning Theory	Technological, economic and organisational drivers are critical considerations in cloud ERP adoption decisions by SMEs followed by environmental, innovation, human and vendor related issues.
Lal & Bharadwaj (2016)	Explores the factors driving cloud-based services adoption	Organisation	DOI, TOE and TAM	Cloud-based services offer a relative advantage regarding on-demand deployment services, accessibility and scalability
Martins et al. (2016)	Uncovers the determinants of SaaS diffusion and their impact on the three stages of diffusion (for example; intention, adoption, and routinization) and taking account the level of impact	Organisation	DOI, TOE and Institutional theory	Relative advantage, top management support, cost savings; complexity, technology competence and normative pressures influence SaaS

Study	Purpose of the study	Context	Theory	Findings
	between the stages.			adoption intention.
Osembe & Padayachee (2016)	Assessing cloud computing usage services and the extent of adoption to ascertain the perceptions associated with cloud computing with the view of investigating SMEs in the IT sector.	Organisation	No underpinning Theory	71,4% of the respondents used cloud computing and that SaaS, IaaS and PaaS services were implemented by IT SMEs in Gauteng province.
Van de Weerd et al. (2016)	Investigates perception in Indonesian companies on how the following organisational factors which are top management support, organisational size and organisational readiness influence the decision to adopt SaaS.	Organisation	DOI and TOE	Top management support is highly important in SaaS adoption compared to other factors like organisational size and organisational readiness

Table 3: Past Studies of SaaS Adoption

It is evident from the above summary of studies that research conducted to understand what drives the adoption of cloud-based software solutions has advanced across different countries (Lal & Bharadwaj, 2016). Lee (2013) studied cloud-based software adoption and categorised adoption drivers into four main parts, which are suppliers, customers, technological and environmental. They indicated that out of the four drivers technological and environmental are the main considered drivers.

Salum & Rozan (2015) studied the barriers and drivers developed in the cloud ERP adoption decision by SMEs, and the findings pointed out that technological, organisational and economic drivers are important discussions in cloud ERP adoption decisions made by SMEs. From an IT executive's viewpoint, Benlian and Hess (2011), found a perceived cost advantage drives cloud adoption. However, there are a number of disadvantages for adopting cloud-based software, studies conducted by Safari (2015), Subashini and Kavitha (2011) demonstrate that security is the primary area of concern for organisations adopting the cloud-based software. To add more, in the recent study by Akande and Van Belle (2014) which also pointed out that within higher education, security is also one of the biggest challenges with regards to cloud adoption preceded by cloud performance and cloud availability. In the study done by Fassen, which shows that SMEs in South Africa are, wary to adopt SaaS cloud ERP due to data security risks, system performance, and system availability risks (Fassen, Seymour & Schuler, 2013).

Trust towards the cloud provider was identified as the major concern when making a decision to adopt the cloud-based software (Wu, Shen, Wu & Li, 2011). Most recently, Van de Weerd, Mangula & Binkkemper (2016) found out that the support from top management is the strongest enabler for SaaS adoption and that SMEs are more likely to adopt SaaS than large companies. This preliminary review of the literature demonstrates that the adoption of cloud-based software has been studied at large to understand the benefits and the barriers of cloud adoption. Moreover, TOE has often been employed to understand adoption. Those studies suggest that there are potentially a large number of factors affecting adoption of cloud-based software and that these factors need to be explored further. In particular, there are technology-related factors such as cost, security, compatibility (Rogers, 1995; Bhattacherjee & Park, 2014) to consider, there are organisational factors such as top management support that also appear to play a vital role in cloud adoption decision (Chan & Chong, 2012) and even environmental factors such as mimetic, normative and coercive pressures (Pishad et al. 2014) that are necessary considerations.

Lechesa et al. (2012) argue that environmental factors influence the adoption of cloud-based software. System trust, network limitation, regulation as well as security and privacy were identified as environmental factors playing a role in the decision to adopt cloud-based software. The level of system trust affects the decision to adopt cloud-based software (Lechesa et al. 2012).

In the South African context, Cohen et al. (2014) administered a survey on understanding organisational adoption of cloud computing and found that need for legitimacy and external pressures influences organisational adoption behaviours and the study also lays out vital evidence for top managers with regards to the role they play in responding to the external pressures in the process of technology innovation adoption. Lechesa et al. (2012) carried out a small qualitative study focused specifically on cloud ERP to determine factors affecting the adoption of ERP SaaS and found that the environmental factors emerged as the key factors impacting the decision to adopt ERP SaaS. The summary from the literature is depicted in Table 4.

Benefits	**Challenges**	**Enablers**	**Pressures**
Reduced Costs	Data Security Risks, System trust, network limitation and Privacy	Top management support	Normative (external) Pressures
Relative advantages	Complexity	Trust in cloud provider	Mimetic Pressures
Access to advanced technology	Internet costs, availability and access	Competence and maturity of internal IT	Coercive Pressures
Improved mobility	Reliability, System performance and System availability risks	Awareness	Competitive(environmental) Pressures
Compatibility	Regulations	Organisational resources	Institutional Pressures

Avram, 2014; Castelina, 2011; Cohen et al, 2014; Chan & Chong, 2012; Lechesa et al. 2012; Oliveira & Martins, 2011; Salum & Rozan, 2015; Yuan et al, 2010.

Table 4: Summary from Literature

Although an understanding about cloud computing is emerging, it was found that few studies focused specifically on the context of SMEs and very little work in the South African context with (Lechesa, 2012; Cohen et al. 2014; Osembe & Padayachee, 2016; Madisha & Van Belle, 2011) being notable exceptions. The relative effects of different factors internal to the organisation on cloud adoption by South African SMEs is not yet clear. For example, while Cohen et al. (2014) show top management and external factors as important, Madisha & Van Belle (2011) point to technological issues and security factors. It is also not clear to what extent certain specific SaaS solutions have been adopted, which are more popular and which are lagging.

Therefore, there remains a need to understand the state of SaaS adoption in the South African SME context: hence this study is posing the following research questions.

1. **What is the current state of adoption of cloud-based software solutions (SaaS) as reported by SMEs in South Africa?**
2. **What are the technological, organisational and environmental factors perceived to be influencing South African SMEs to adopt cloud-based software solutions (SaaS), and what are their relative effects on adoption?**

CHAPTER CONCLUSION

This chapter reviewed the literature on the adoption of cloud-based software. It showed that few studies specifically focused on the context of SMEs and very little work in the South African context. Past studies were reviewed where it was identified that research conducted to understand the driving force behind the adoption of cloud-based software has advanced across different countries. The next chapter will discuss the underpinnings of the research model together with the development of the model and the hypotheses.

CHAPTER 3: THEORETICAL BACKGROUND AND RESEARCH MODEL

3.1 Introduction

Informed by past works reviewed above, and to assist in addressing research question 2, this chapter develops a theoretical research model for cloud-based software adoption of South African SMEs.

The purpose of the study is to develop and test a model of the factors affecting the adoption of cloud-based software solutions within SMEs context in South Africa. The Technology – Organisational – Environment (TOE) framework, diffusion of innovation (DOI) and Institutional theory are considered to be the most appropriate theoretical models for this study because they are often used in innovation adoption at an organisational level (Oliveira, Thomas & Espadanal, 2014).

According to literature, past research has used the TOE framework, institutional theory and diffusion of innovation theory to understand IT adoption. Therefore, to assist in exploring factors affecting organisational adoption of cloud-based software solutions, this chapter first presents a discussion of the technology, organisational, and environmental (TOE) framework on adoption, diffusion of innovation (DOI) and Institutional Theory as the study's underpinnings. Then it identifies variables from DOI, institutional theory and TOE framework that may have an effect on the adoption of cloud-based software solutions.

3.2 Technology Organisation Environment (TOE) Framework

Tornatsky and Fleischer (1990) developed the TOE framework to analyse adoption of technologies at the firm level using three types of contexts that may influence technological innovation adoption and the implementation process (Guitierez, Boukrami &Lumsden, 2015). These are the technological context, organisational context and environmental context (Zhang, Cui, Huang & Zhang, 2007). Technological context specifies technologies available to an organisation (Arpaci, Yardimci, Ozkan &Turetken, 2012). Organisational context provides a description of the features for an organisation, and those features include scope, geographic dispersion of the firm and the resources available within a firm (Arpaci et al. 2012).

Environmental context comprises the industry format, the presence or the unavailability of the technology's service provider and the regulating environment (Baker, 2011). Decision makers should take these technological, organisational and environmental factors into account when making decisions (Thong, 1999; Arpaci et al. 2012). TOE factors are illustrated in Figure 4.

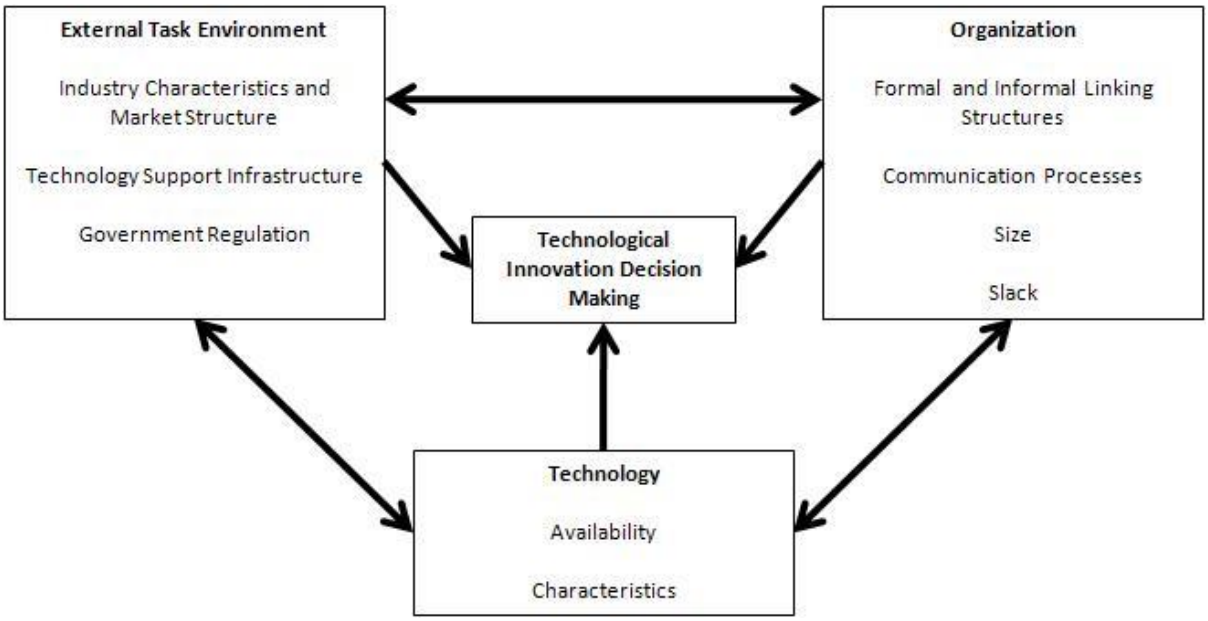

Figure 4: TOE framework

(Source: Tornatzky & Fleischer, 1990)

Subsequently, TOE has been extended and combined with other theories. For example, a study by Thong (1999) used diffusion of innovation theory alongside TOE to identify determinants of technology adoption for small business, while studies by Wang and Zhu, Dong, Xu, and Kramer (2006) merged TOE framework with DOI theory to have a better understanding of decisions made when adopting IT (Wang, Wang & Yang, 2010). Moreover, a study by Martins, Oliveira, and Thomas (2016) used TOE, DOI, and institutional theory to assess the factors influencing the diffusion of SaaS in firms. Li (2008) joins TOE structure with DOI and institutional theory in line with explaining the organisational adoption of e-procurement. Studies by Gibbs and Kraemer have also merged institutional theory together with the TOE framework (Gibbs& Kraemer (2004)

Lechesa used TOE and institutional theory to determine factors affecting the adoption of ERP SaaS in South Africa (Lechesa et al. 2012). This study differs from previous studies done by Lechesa, because this study focuses on SaaS cloud-based solutions more broadly, not just only cloud-ERP. Also, this study intends to focus on a large sample of SMEs in South Africa with a quantitative approach as opposed to Lechesa's qualitative investigation with five interviews.

It is also evident from the past information systems (IS) research that a better understanding of technology adoption can be achieved by extending TOE to include factors drawn from other theories. Specifically, both diffusion of innovation theory (DOI) and institutional theory are necessary to consider. Therefore this study will supplement the TOE framework with DOI and institutional theory as theoretical lenses examining factors affecting adoption of cloud-based software solutions.

3.3 Diffusion of innovation (DOI) theory

Diffusion of Innovation (DOI) theory explains the process through which an innovation diffuses across a context. It posits that innovation goes through five stages. Those stages are, knowledge, persuasion, decision, implementation and confirmation stage (Rogers, 2003). The knowledge stage incorporates exposure to innovation. The persuasion stage describes the degree of interest in the innovation, and this is more affective centered hence individuals can build positive or negative attitudes towards accepting or rejecting the innovation (Rogers, 2003; Martins, Oliveira & Thomas, 2016). Moving along, there is a decision stage where by individuals then make a decision to adopt or rejects an innovation (Rogers, 2003). Once the decision has been made then, it needs to be put in practice by implementing it which then leads us to the implementation stage which is also called routinization (Martins et al. 2016). The last stage which is the confirmation stage whereby the innovation is reinforced (Martins et al. 2016) and individuals seek confirmation to support the decision that has been made about the innovation (Rogers, 2003). Therefore, innovation stages assist us in the process of establishing the current state of the adoption of cloud-based services. Figure 5 illustrates the diffusion curve.

Diffusion of Innovation (DOI) theory, propose that the diffusion of technology innovation is determined by the innovation features such as relative advantage, complexity, and compatibility (Yang, Sun, Zhang & Wang, 2015). Relative advantage is the degree to which technology innovation is perceived to bring benefits to the organisation (Thong, 1999). Compatibility is the extent to which an innovation is perceived consistent with the present values, needs, and past experiences of the potential adopter (Chong & Chan, 2012). Complexity is the degree to which technology innovation is perceived as difficult to use (Oliveira et al. 2014). From the cloud-based services' perspective, relative advantage can be viewed as providing greater benefits including reducing the total cost of ownership (Lal & Bharadwaj, 2016). Compatibility can be viewed as the fit between SaaS solutions and the processes and information processing needs of the SMEs while complexity can be viewed as the extent to which SaaS solution is perceived as being complex to use (Martins et al. 2016). Thus this study aims to find out how SMEs perceive the relative advantage of SaaS. These three are generally considered the most relevant among the DOI factors. (Tornatsky & Klein, 1982). The diagram below in Figure 5 illustrates the diffusion of innovation theory.

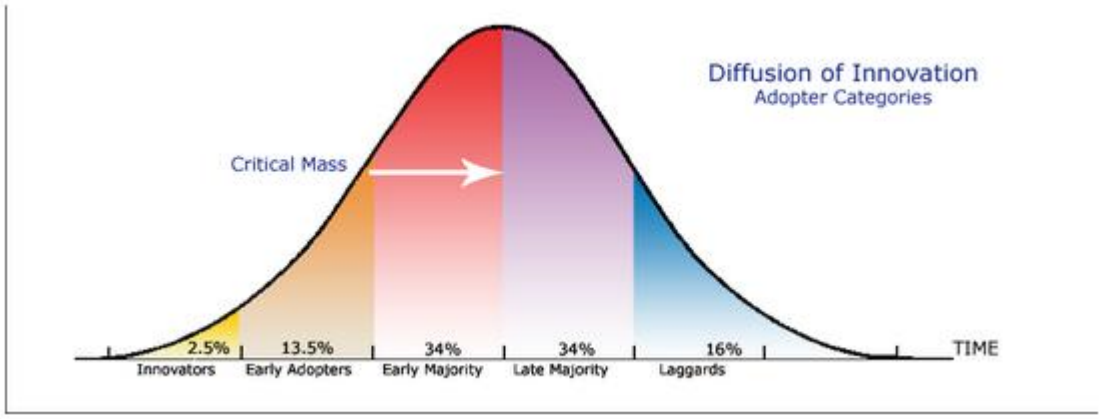

Figure 5: Diffusions of Innovation Theory

3.4 Institutional theory

Furthermore, institutional environments in which organisations operate may influence cloud-based software adoption. Within cloud-based software solutions, those environments consist of trading partners, competitors, and customers (Chan & Chong, 2012). Institutional theory highlights that "institutional environments are critical in shaping actions and organisational structure" (Oliveira & Martins, 2011, pg. 116). From an institutional theory perspective, for example, if a firm wants to decide whether to adopt cloud-based software solutions, that firm is likely to be convinced to implement cloud-based software solutions based on pressures arising from competitors, business partners, customers and government (Oliveira & Martins, 2011). The central position of the institutional viewpoint is that firms sharing the same environment will become isomorphic with each other and end up applying similar practices (Chan & Chong, 2012). In addition, from an institutional point of view, there is a high probability that firms attached to the public sector will adopt the technology that is supported by the government policy (Zhang et al. 2007).

The institutional theory thus suggests that three kinds of isomorphic pressures namely, mimetic, normative and coercive, influence firm behaviours (Dimaggio & Powell, 1983; Pishad, Koronois, Reich & Geursen, 2014). Cohen highlights that when drawing on institutional theory, it is important to identify which of the three isomorphic pressures are likely to be more relevant to a specific adoption context. Their study focused on mimetic and normative pressures, therefore omitting coercive pressures as they were considered less likely to be important to the adoption of technologies that are not subjected to strong government regulation (Cohen, Mou & Trope, 2014). In this study, therefore, organisations are considered to make a decision to adopt a technology based on the environmental context to mimic what other organisations are doing and in response to pressure from other organisations that have already adopted the technology.

3.5 Research Model

The study's research model is depicted in Figure 6. The research model draws on the TOE framework, DOI, and institutional theory to better understand factors affecting the adoption of cloud-based software solutions. The research model identifies three sets of constructs proposed as factors affecting the adoption of cloud-based software solutions. These are:

a) Technological Context - Drawing on DOI, compatibility, complexity and relative advantage is included as factors in the technological context (Rogers, 1995). Also security, trust and cost are also included as technological factors.
b) Geographic dispersion, top management support, and skills of IT resources are incorporated as factors in the organisational context drawn from TOE framework (Tornatsky & Fleischer, 1990).
c) Mimetic, coercive pressures and normative pressures are drawn from institutional theory and included as factors in the environmental context (Di Maggio & Powell, 1983).

The proposed constructs from DOI, TOE and institutional theory used in this study were selected because of their applicability to SaaS adoption (Oliveira et al. 2014). Adding to DOI constructs, security concern and trust were included within the proposed model because security concern is one of the main concerns for firms wanting to adopt a new technology (Alkhater, Wills & Walters, 2014), with trust being a positive enabler of the firm's decision to acquire a new technology (Adjei, 2015). The cloud provider must assure the firm that they have the ability to render good service as well as the ability to secure sensitive information in the interest of the firm acquiring a new technology (Adjei, 2015). The reputation and competence of the cloud provider are considered as important towards the decision to adopt new technology (Manuel, 2013).
Each of the factors depicted in Figure 6 is explored next, and the hypotheses underpinning the model are derived.

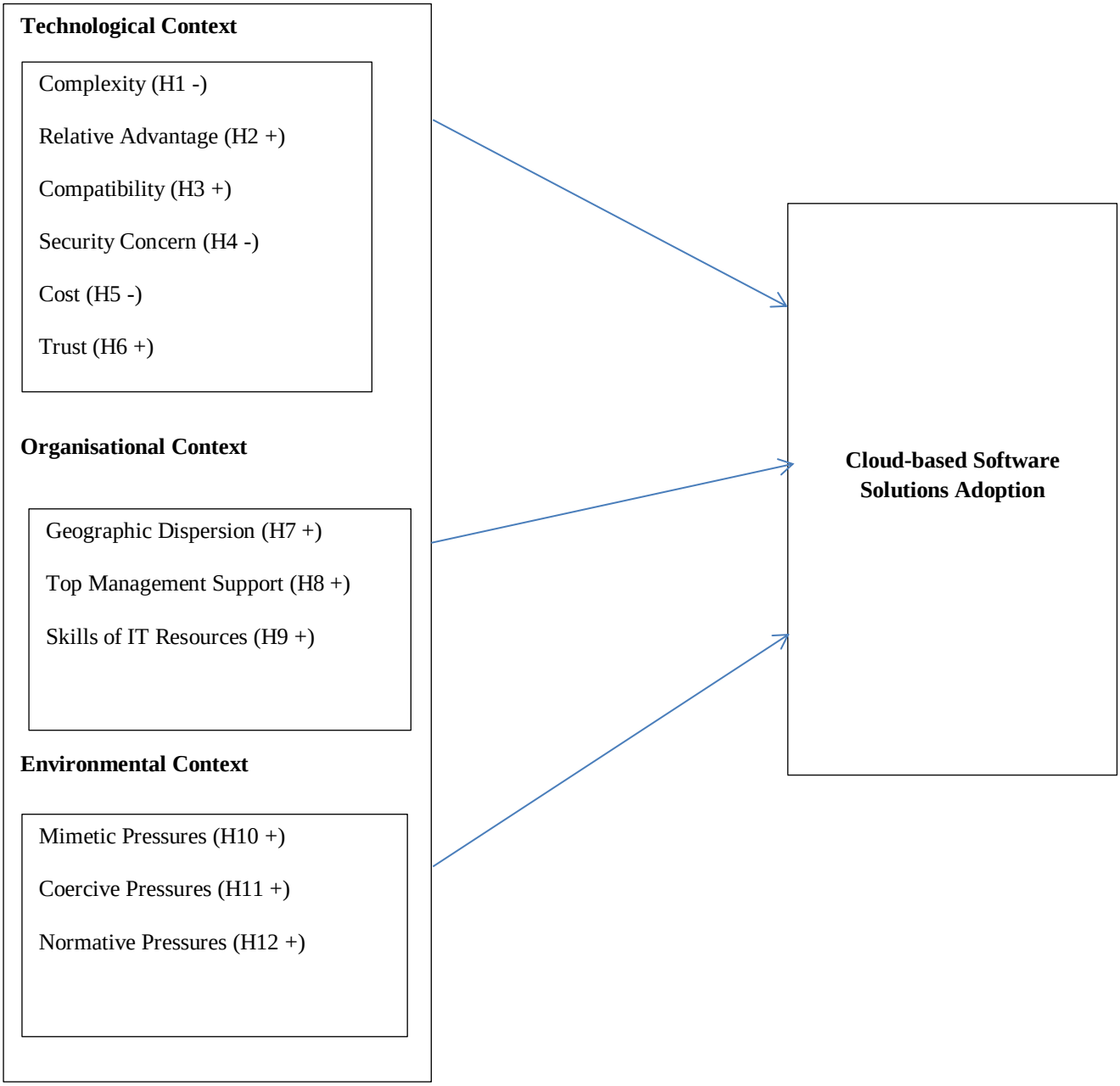

Figure 6: Research Model

3.5.1 Technological Context

Technological context relates to the properties of emerging technologies and innovations that are currently being used by the organisation (Guitierrez et al. 2015; Van de Weerd et al. 2016). Drawing from DOI, the technological factors include relative advantage, perceived complexity, and perceived compatibility amongst other factors.

Complexity is the extent to which technology is pictured as complex to use (Oliveira et al. 2014).

Gutierrez et al. (2015) point out that new technology must be easy to use and manage so that the adoption rates rise. If organisations perceive cloud software as complex to use, the adoption rate might be low (Gutierrez et al. 2015). Therefore it can be hypothesized that:

H1 – Perceived complexity of cloud-based software will be negatively related to cloud-based software adoption.

Relative advantage is "defined as the degree to which technology innovation is perceived to bring benefits to the organisation" (Oliveira et al., 2014, p.12). According to Lal & Bharadwaj (2016), relative advantage includes the scalability, accessibility and on-demand deployment of cloud services. However, the constructive outcome can be mitigated if organisations encounter high expenses for the technology to be innovated (Bhattacherjee & Park, 2014).

Lee (2004) and Thong (1999) declared that when organisations recognize the relative advantage of technology to be higher than other alternatives, there is the possibility that the adoption will increase (Guitierrez et al. 2015). Therefore it can be hypothesized that:

H2 – Perceived relative advantage of cloud-based software will be positively related to cloud-based software adoption.

Compatibility is an extent which the technology is viewed to be in line with the current and the essential needs of the firm planning to adopt an innovation (Chan & Chong, 2012). The organisation may perceive cloud-based software solutions to be compatible if it has a greater fit to the organisation's current situation (Martin et al. 2016).

SMEs need to integrate cloud-based software solutions with other applications that the organisation is using, and thus they are less likely to receive it positively if they believe that the innovation is not a good fit to their current infrastructure or practices. Conversely, SMEs that which perceive greater compatibility in cloud-based software solutions are more likely to adopt it. Therefore, it can be hypothesized that:

H3 – Perceived compatibility of cloud-based software will be positively related to cloud-based software adoption.

The security concerns arise because of the dependency of the firm on the cloud provider's capability to protect sensitive personal information from being hacked during transactions and over longer-term storage of data (Salisbury, Pearson, Pearson& Muller, 2001). Bhattacherjee and Park (2014) highlight that previous studies have established security concerns to have an inverse effect on innovation adoption more broadly (Goodhue & Straub, 1991), and this negative effect should be similarly pronounced in the context of cloud-based software solutions. However, if potential adopters are

convinced by the cloud vendor's ability to alleviate security breaches, then they are more likely to adopt (Bhattacherjee & Park, 2014).

Prior studies have found security concerns to have a negative effect on the intention to adopt technology innovation (e.g., Bhattacherjee & Park, 2014).
Therefore, it can be hypothesised that:

H4 – Security concerns over cloud-based software will be negatively related to cloud-based software adoption.

Costs are concerned with the expenses involved in the implementation of the technology for functions and their business processes (Chan & Chong, 2012). The cost of an innovation thus has numerous elements extending beyond initial speculation costs through to operational expenses and the cost of preparing clients to utilize the development (Rostami, Akbari & Javan, 2014). Premkumar argues that cost has been examined as a factor influencing adoption by many studies in innovation (Premkumar, Ramamurthy &Nilakanta, 1994). Perceived advantages can be tempered if organisations perceive high costs are associated with the adoption, operation, training and organisational restructuring needed to make use of cloud technologies.

Therefore, it can be hypothesized that:

H5 – Cost of cloud-based software will be negatively related to cloud-based software adoption.

Manuel (2015) defines trust as the confidence that the firm put in the cloud provider to perform functions that both parties have agreed on as stipulated in the service level agreement. Trust is a vital factor involving uncertainty and dependency in many economic and social interactions specifically those concerned with taking crucial decisions in the adoption of a new technology (Gefen, 2000). Trust is critical because choosing a trustworthy cloud provider is important (Abbadi & Alawneh, 2012). In the cloud-based context, adopting firms need to be willing to rely on cloud provider (Corbitt, Thanasankit & Yi, 2003). Without confidence in the reliability and the trustworthiness of the cloud software provider, adoption is unlikely.

Therefore it can be hypothesized that:

H6 – Trust in the cloud-based software provider will be positively related to cloud-based software adoption.

3.5.2 Organisational Context

In this study, the organisational context includes three factors which are the geographic dispersion, top management support, and the IT resources skills. The three factors have an impact on the decision to adopt a technology.

Geographic dispersion has been defined in multiple ways across different disciplines. In this study's context, O' Leary and Cummings (2007) defines geographic dispersion as the extent to which components in a firm are situated across a large number of branches or sites. Geographic dispersion can also imply a need for mobility (Yuan, Archer, Connelly & Zheng, 2010). Mobility is how one performs task in various locations (Yuan et al. 2010). If the SME has employees that need to be mobile then access to software functionality delivered on the cloud might be useful. The sharing of information across multiple sites maybe easier among firms that have adopted SaaS since all data and functionality operates on the cloud. SaaS solutions may also make deployment of the latest software releases automatic, and thereby help to ensure all the sites will be on par (Buyya, Yeo, Venugopal, Broberg & Brandic, 2009).

SMEs whose operations are more geographically dispersed with greater need for mobility are more likely to adopt SaaS.

Therefore, it can be hypothesized that:

H7 - Geographic dispersion of the SME organisation will be positively related to cloud-based software adoption.

Top management support is defined as guidance provided by senior management with an organisation to the allocation of resources and the service integration with the firm (Chan & Chong, 2012). Support from top management plays vital a role in IT adoption in that top management leadership can stress the role of innovation within the organisation and the importance of the innovation to subordinates (Tushman & Nadler, 1986). Gutierrez argues that top management support is vital to ensure appropriate resources, for example, technical expertise is acquired to adopt cloud services (Gutierrez et al., 2015). Top management support is also needed for facilitating a successful change process that may be necessitated by the introduction of new ways of working brought by the innovation (Zmud, 1984) Therefore it can be hypothesized that:

H8 - Top management support will be positively related to cloud-based software adoption.

In addition to appropriate technology infrastructure, skilled IT resources within an organisation are vital for the adoption of innovation. SMEs that do not have adequate IT skills may not be in a position to deploy new technologies because they may be unaware of those new technologies.

Skills of IT resources have been considered and used as a vital variable to predict adoption in the diffusion of innovation research (Premkumar & Roberts, 1999). Thus SMEs which have high skills of IT resources are more likely to adopt cloud-based software solutions (Premkumar & Roberts, 1999). Therefore it can be hypothesized that:

H9 – Skills of IT resources will be positively related to cloud-based software adoption.

3.5.3 Environmental Context

Institutional environments are critical in moulding organisational structure and actions (Oliveira & Martins, 2011). Drawing from institutional theory, the environmental context includes three factors which are mimetic pressures, coercive pressures and normative pressures (Pishad et al. 2014)

Mimetic pressures can be defined as pressure arising when organisations try to remain similar to competitors hoping to achieve similar success (Liang, Saraf, Hue & Xue, 2007). Mimetic pressures may cause an organisation to mimic other organisations similar to them regarding environment. (Dimaggio & Powell, 1983). If organisation A has implemented cloud-based software solutions and organisation B wants to implement cloud-based software solutions, there is a higher possibility that organisation B will end up implementing cloud-based software solutions because they saw that organisation A has benefited from cloud-based software solutions. Therefore it can be hypothesized that:

H10 - Mimetic pressures will be positively related to cloud-based software adoption.

Coercive pressures are official forces utilised on an organisation by other organisations to which they are dependent (Dimaggio & Powell, 1983). Teo argues that organisations may also experience coercive pressures from root corporations in addition to resource dominant trading partners (Teo, Wei & Benbasat, 2003).

Within FEDI technology adoption context, coercive pressures emanate mainly from the leading suppliers and leading customers (Teo et al. 2003). Similar pressures may promote SaaS adoption. Therefore it can be hypothesized that:

H11 - Coercive pressures will be positively related to cloud-based software adoption.

Normative pressure relates to the moral and efficient aspects of authority evaluating if the organisation plays its role properly and in a sensible way (Liang et al. 2007).

The institutional theory proposes that by learning different types of entrepreneurial norms and values, organisations face normative pressures to adopt new business practices (DiMaggio & Powell, 1983). Generally, organisations adhere to normative pressures by applying the practice to business because

they typically identify adoption as most relevant (Richard, 2003). Therefore it can be hypothesized that:

H12 - Normative pressures will be positively related to cloud-based software adoption.

3.6 CHAPTER CONCLUSION

This chapter presented the study's theoretical background. It developed a research model consisting of 12 hypotheses by drawing on TOE, DOI and Institutional theory. The hypotheses are summarized below. The next chapter presents the research methodology used to address the study's research questions and test the research model. Research question 1 requires a descriptive analysis of the state of SaaS adoption within South African SMEs. Research question 2 requires the testing of the hypothesized research model. The research methodology to be used to address research questions is discussed next.

Hypothesis	Definition
Hypothesis 1	*Perceived complexity of cloud-based software will be negatively related to cloud-based software adoption.*
Hypothesis 2	*Perceived advantage of cloud-based software will be positively related to cloud-based software adoption.*
Hypothesis 3	*Perceived compatibility of cloud-based software will be positively related to cloud-based software adoption.*
Hypothesis 4	*Security concerns over cloud-based software will be negatively related to cloud-based software adoption.*
Hypothesis 5	*Cost of cloud-based software will be negatively related to cloud-based software adoption.*
Hypothesis 6	*Trust in the cloud-based software provider will be positively related to cloud-based software adoption.*
Hypothesis 7	*Geographic dispersion of the SME organisation will be positively related to cloud-based software adoption.*
Hypothesis 8	*Top management support will be positively related to cloud-based software adoption.*
Hypothesis 9	*Skills of IT resources will be positively related to cloud-based software adoption.*
Hypothesis 10	*Mimetic pressures will be positively related to cloud-based software adoption.*

Hypothesis	Definition
Hypothesis 11	*Coercive pressures will be positively related to cloud-based software adoption.*
Hypothesis 12	*Normative pressures will be positively related to cloud-based software adoption.*

Table 5: Summary of Hypotheses

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

This chapter discusses the approach to be followed to collect and analyse data to answer the research questions and test the hypotheses. The research paradigm and approach, research design, research strategy, and data collection methods followed in this study are discussed. Ethical considerations in connection with the study are also discussed along with limitations of the methodology.

4.2 Research Paradigm and Approach

The discussion of this study's research methodology has been informed by adapting the "Saunder's onion" **(**Saunders, Lewis & Thornhill, 2012). Accordingly, it is necessary to describe the research philosophy and approach, then the research design and strategies prior to details of data collection methods.

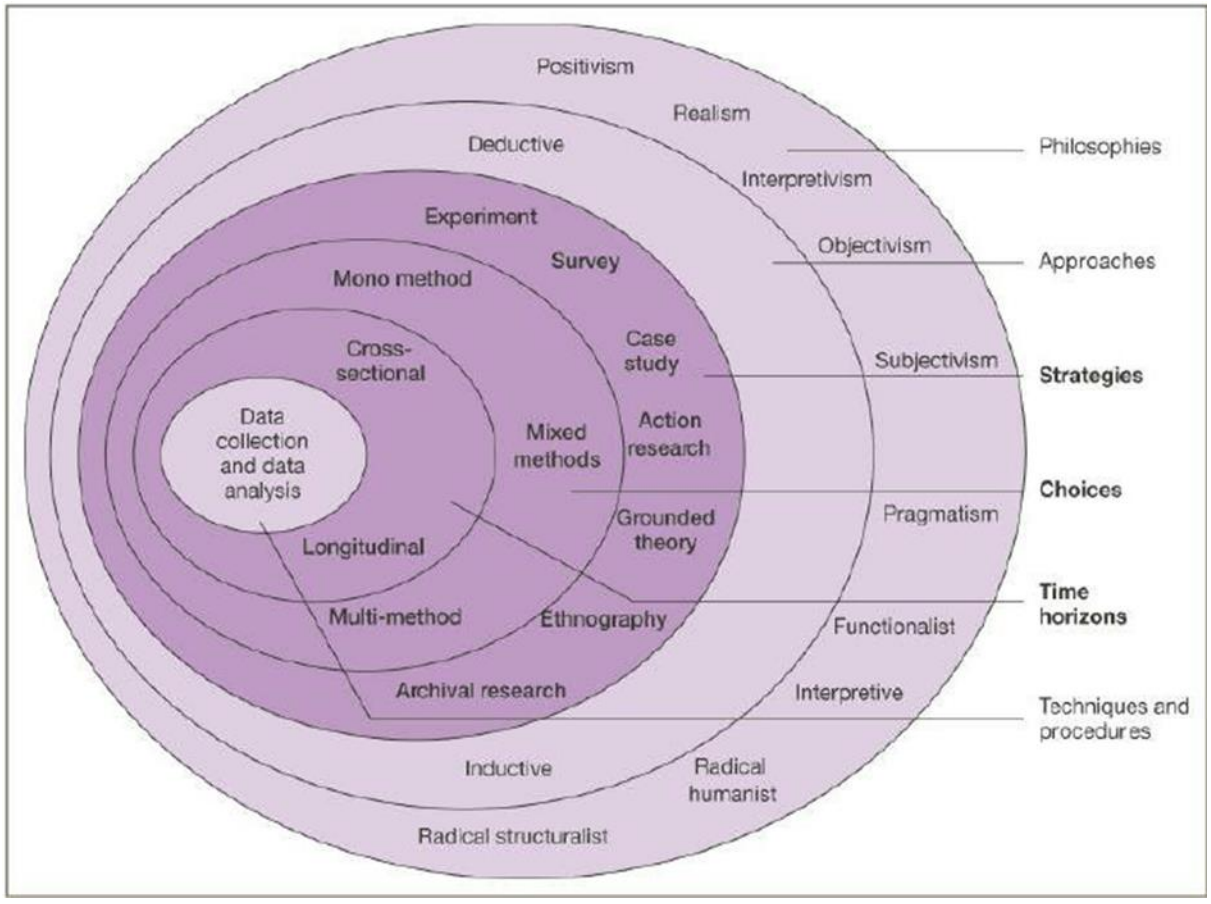

Figure 7: Research Methodology Onion.

Source: Adapted from Saunders, Lewis &Thornhill. 2012, Research methods for business students. 6th Pearson Education.

In the social science research, there are two main research paradigms which are positivism and interpretivist (Bhattacherjee, 2012). Positivistic research perspective was found to be dominant within the information systems research (Orlikowski and Baroudi, 1991). Positivism is generally related to quantitative research methods (Pinsonneault and Kraemer 1993). Quantifiable measures of variables are used to draw inferences from a sample to a population (Orlikowski and Baroudi, 1991). Additionally, positivistic approach gathers data objectively and in a manner that minimizes the influence of bias from the researcher's values and attitudes with the aim of reducing the threat of subjectivity (Hussey & Hussey, 1997). Positivism is associated with the use of appropriate and structured instrumentation to investigate the relationship that exists between predefined variables (Straub, Boudreau & Gefen, 2004).

On the other hand, interpretivist research is correlated with qualitative research methods which explore and describe the meaning of a phenomenon (Hussey & Hussey, 1997). Interpretivist researchers' view our knowledge of reality as expanded only through social constructions such as language, documents and other artefacts (Klein and Myers, 1999). Interpretivist methods use interviews and observations as their means for data collection (Bhattacherjee, 2012). Qualitative researchers analyse data by the use of coding and aim to interpret the meaning of variables to be able to build theories (Saunders et al. 2012). Thus quantitative data can take form of numbers while qualitative data can take the form of words (Cohen, Manion & Morrison, 2000).

Although positivist research is more likely to employ quantitative research technique and interpretive research more likely to employ qualitative research techniques, neither is restricted to a specific method (Bhattacherjee, 2012). The qualitative research methodology treats people as research participants and not as objects as in the positivist research approach. Table 5 summarises the differences between positivist and interpretivist philosophies.

	Positivist	Interpretivist
Ontology	Is separated from the study	Cannot be separated from the study
Epistemology	Objective	Subjective
Role of Researcher	The researcher is independent of the study in order for the data not to be biased after analysis. The research would use standard ways of conducting research and would use data collections methods such as random sampling to increase the generalisability of the study.	The researcher's personal experiences and belief can be reflected in the design of the research which evaluates people's perceptions. The researcher is considered as part of the research having the ability to influence the results.
Research approach	Deductive	Inductive
Methods	Mostly Quantitative	Mostly Qualitative
Research Methods	Scientific, e.g. experiments, field experiments and surveys	Ethnographic, e.g. case studies and interviews

Bhattacherjee, 2012; Creswell, 2003; Gioia & Pitre, 1990; Weber, 2004; Orlikowski & Baroudi, 1991

Table 5: Comparison of Positivist and Interpretivist Research

Positivist research tends to be deductive, that is conclusions can be drawn about a phenomenon based on theory (Bhattacherjee, 2012). This study is starting with theory prior to observation and therefore follows a hypothetico-deductive approach. More specifically, the study has drawn on the TOE framework along with diffusion of innovation and institutional theory to develop a- prior research model hypothesizing the effects of selected technological, organisational and environmental variables on cloud software adoption behaviour. Hypothetico-deductive approach assumes that theories are empirically testable with the aim of testing the verification or falsification of the theories' hypothesis (Orlikowski& Baroudi, 1991).

4.3 Research Design and Strategy

Research design defines the blueprint of activities that should be conducted to be able to respond to the research questions (Bhattacherjee, 2012). Typical research designs include exploratory research which aims to understand the what in order to create a basis for the future (Bhattacherjee, 2012). Descriptive research designs aims to apply scientific methods to the observations thus becoming more reliable than causal observations made in a non-scientific manner (Bhattacherjee, 2012). Experimental or causal research aims to test the relationship between the cause and the effect (Bhattacherjee, 2012). Relational research also referred to as weak causal research has an objective to offer an insight into the link between two or more variables typically through fieldwork and other non-experimental studies (Bhattacherjee, 2012). Relational research is typically used to predict possible human behaviours and potential outcomes (Johnson & Onwuegbuzie, 2004). Relational research aims to explain how things are happening and why are they happening? It tries to establish the associations of things happening within the research phenomena. Variables are identified and controlled within the research environment to explain the cause better using their characteristics (Hussey & Hussey, 1997). However, because relational research cannot control for all confounding effects nor properly establish temporal precedence in the data, it is considered a weaker form of causal study, predominantly based on correlational evidence (Shadish, Cook & Campbell, 2002).

This research study posed two research questions, namely: What is the current state of adoption of cloud-based software solutions (SaaS) as reported by SMEs in South Africa? Also, what are the technological, organisational and environmental factors perceived to be influencing South African SMEs to adopt cloud-based software solutions (SaaS), and what are their relative effects on adoption? Thus this study aimed to explain SaaS adoption within South African SMEs as the function of the factors hypothesised in Figure 6 (See Page 41).Consequently, this study has employed a relational research design. To the extent that this study also seeks to describe the state of SaaS adoption among South African SMEs, the study is also descriptive. The key characteristics of descriptive research are its focus on accurately portraying characteristics of an individual, situation or group of interest (Bhattacherjee, 2002) and reporting on what has happened or is happening (Kothari, 2004).

Descriptive and relational research is typically carried out using one of three types of research strategies, namely natural observation, survey research and archival research. The survey research method is appropriate for this study. Survey research method allows for data to be collected in the field from a random sample of participants, typically using a questionnaire instrument. This study used a cross-sectional survey as the data collected on all variables at the same point in time. Surveys also provide for sampling a large number of the members of a population and this provides results that are more generalizable to the population (Yoon, 2009).

The survey research method is suitable for this study because it grants the researcher to generalize from the sample to a population for the purposes of the statistical inferences to be made about characteristics and behaviour of the population (Creswell & Clark, 2007). With survey research, the researcher can examine multiple variables concurrently and study a problem from multiple perspectives (Bhattacherjee, 2012; Gable, 1994). Another strength of a survey design is that it allows the researchers to explore multiple variables (Bhattacherjee, 2012; Gable, 1994). A limitation of the cross-sectional, relational study is that it depends on strong theory to infer causation from correlational evidence (Shadish et al., 2002). This is because temporal precedence is not established in the data.

4.4 Data Collection Method

This study intends to investigate the state of the adoption of SaaS and the factors affecting cloud-based software adoption within South African SMEs. A survey methodology has been adopted, and this study used structured questionnaire as the data collection instrument (Henn, Weinstein & Foard, 2009). Survey research strategy is often associated with questionnaires (Bhattacherjee, 2006). A questionnaire was developed to conduct a survey of SMEs that are considering adopting SaaS as well as those that have already adopted SaaS. The final survey questionnaire was administered to SMEs starting in November 2017. The questionnaire was attached as a link in an e-mailed invitation to participate in the survey, or was printed for paper-based administration (See Section 4.4.4). This implies the use of mono-method for data collection. The survey was also cross-sectional in nature. This means that data was collected and analysed in a single point in time (Cooper & Schindler, 2006).

4.4.1 Measurement and Instrument Construction

Operationalization is "the process of developing indicators or items for measurement of constructs" (Bhattacherjee 2012, pg. 44). When items that measure the constructs are developed, the underlying concepts need to be defined and measurement items assigned to them. Construct operationalization is a major step to assure that measurement of the construct is reliable and valid (Saunders, Lewis & Thornhill, 2009). To establish content validity for the questionnaire items, items were drawn from literature. Measurement items were developed by surveying known existing instruments from the IS literature, establishing items and selecting applicable items based on relevance. The measures were adapted from existing scales found in the literature.

All items were measured using a five-point Likert scales ranging from strongly disagree to strongly agree (See Table 8). A single item was used to determine if the respondents adopted any of the ten SaaS technologies – Cloud ERP, Cloud CRM, Cloud email, Cloud productivity, Cloud financial or payroll tools, Cloud e-commerce platform, Cloud storage, Video conferencing, IT helpdesk/ ticketing, and Virtual team communication. The survey was executed via an online survey link which was e-

mailed to the participants. In order to encourage more participation, reminders were emailed every week to the participants.

Table 7 provides example items sourced from the literature that will be used to measure each of the independent variables in the study. Except for firm size, the items are all measured on a 5-point Likert scale ranging from 1= strongly disagree to 5= strongly agree. Table 6 presents the measures for the dependent variable, the adoption of cloud software. In addition to measure adoption of SaaS, respondents were asked to indicate whether they have adopted a selected set of SaaS technologies as listed in the Table 9, and if they had not already adopted whether they had plans to adopt the SaaS technology. Respondents were also asked to indicate the approximate year in which they first adopted SaaS technology. The control variables included in the questionnaire were firm size, firms industry, number of years in the firm, job title.

Variable	Conceptual Definition	Example Item (Measures)	Number of items	Literature Reference
Complexity	The degree on which an innovation organisation improvement will be recognized as extreme to utilize.	The use of cloud-based software will be complicated for our organisation to use	4	Oliveira et al., 2014
Relative Advantage	The extent to which a technology innovation is identified to present benefits to the organisation	The use of cloud-based software will improve quality of operations	5	Oliveira et al., 2014
Compatibility	The degree will which an improvement is observed Similarly as steady for those existing values, needs, and previous encounters of the possibility adopter.	Cloud-based software is suitable for our current systems, business process, and operations	4	Chan & Chong, 2012
Security Concern	The degree to which users trust in the cloud service provider's capacity to safeguard sensitive personal information from security breaches during transmission and storage	Security concern is an obstacle for adopting cloud-based software	3	Benlian & Hess, 2011
Cost	Expenses for implementing necessary technologies for online transactions as well as those associated with organisational restructuring	The amount of money and time invested in training employees to use cloud-based software solutions are	3	Chan & Chong, 2012

Variable	Conceptual Definition	Example Item (Measures)	Number of items	Literature Reference
	and business process re-engineering	very high.		
Trust	Trust is the confidence that the firm put in the cloud service provider to perform functions that both parties have agreed on as stipulated in the service level agreement.	Cloud-based software vendors are reliable	4	Manuel, 2015
Geographic Dispersion	The extent of which components in a firm are situated across a large number of branches or sites.	Our organisation has various locations	3	O' Leary & Cummings, 2007
Top Management Support	Guidance provided by senior management with an organisation to the allocation of resources and the integration of services with the firm	Top management actively encourages employees to use cloud-based software solutions in their daily tasks	3	Chan & Chong, 2012
Cloud Software Readiness	Is considered and used as a crucial variable in predicting diffusion of innovation adoption research	Our firm is dedicated to ensuring that employees are familiar with cloud-based software	3	Premkumar & Roberts, 1999
Mimetic Pressures	Pressures arising when organisations try to remain similar to competitors hoping to achieve similar success	It is a strategic necessity to use cloud-based software technology to compete in the market place	3	Liang et al., 2007
Coercive Pressures	Official drives exerted on an organisation by other organisations upon which they are dependent on	When cloud-based software vendors say that their cloud-based software is the best, our organisation believe them	5	Dimaggio & Powell, 1983
Normative Pressures	Pressures arising when an organisation with direct or indirect ties to other organisations that have adopted	The adoption of cloud-based software is relevant to our	3	Liang et al., 2007

Variable	Conceptual Definition	Example Item (Measures)	Number of items	Literature Reference
	an innovation can learn about the innovation and its accompanying benefits and costs.	organisation		

Table 6: - Measures for Variables

	SCALE MEASURE FOR CLOUD SOFTWARE ADOPTION	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	My company invests resources in (SaaS) cloud-based software	1	2	3	4	5
2	Business activities in our company require the use of cloud-based software	1	2	3	4	5
3	Applications important to business operations in our firm are running on the cloud	1	2	3	4	5
4	Functional areas in my company require the use of cloud-based software	1	2	3	4	5

Source: Adapted from Bhattacharya M. 2015. A conceptual framework of Radio Frequency Identification Technology (RFID) adoption in retail survey.

Table 7: Measures for Adoption of Cloud Software

SaaS technology	We have adopted	We have not adopted but we have plans to adopt within the next year	We have not adopted and have no immediate plans to adopt	We have not adopted but are not sure about plans	Don't know if we have adopted or not
Cloud ERP, e.g. NetSuite					
Cloud CRM, e.g. Salesforce					
Cloud e-mail, e.g. Gmail					
Cloud productivity tools, e.g. Microsoft Office 365					
Cloud financial or payroll tools, e.g. QuickBooks Online					
Cloud e-commerce platform, e.g. Shopify					
Cloud storage, e.g. Dropbox, Google Drive					
Video conferencing, e.g. WebEx and Skype					
IT helpdesk/ ticketing e.g. Zendesk, Jit Bit helpdesk					
Virtual team communication. e.g. Slack, Microsoft Teams and Trello					

Source: adapted from http://www.gartner.com/it-glossary/cloud

Table 8: Adoption of specific SaaS technologies

4.4.2 Pre- Testing and Pilot Testing

To validate the instrument a pre-test and pilot test was administered before conducting the main survey (Nevo & Wade, 2011). The survey instrument was subjected to pre-testing to strengthen its content validity (Nevo & Wade, 2011). For pre-testing three IS professionals were involved. Pre-testing involved sending the questionnaire to three academics familiar with organisational IT adoption research at Wits University and one industry expert. They were invited to comment on the questions and wording. Feedback received highlighted the following:-

a) Checking of consistency with regards the use of terms. E.g. software and technology.
b) writing the construct' names in full instead of using abbreviations
c) re-wording of some of the questions
d) consistency in numbering questions
e) adding of instructions into the questions
f) numbering of items

The questionnaire was amended as per the feedback. Bhattacherjee (2012) points out that pilot testing is also a vital part of the research. Pilot testing improves the questionnaire by identifying any problems respondents may encounter in the completion of the instruments and also gauge the estimation required in completing the questionnaire (Taylor & Todd, 1995). Pilot testing was performed by sending the survey to a convenience sample of six cloud managers and consultants selected because they are familiar with cloud technologies. The cloud managers and consultants were asked to complete the questionnaire and also to comment and provide feedback to be used make the questionnaire more significant and appropriate. Five responses were received. Completed responses were visually scanned. The wording of items was also checked whereby some of the questions were reworded in a simpler term as per the feedback. The pilot testing helped to establish the face validity of the instrument (Bhattacherjee, 2012). The final questionnaire is attached in Appendix A.

4.4.3 Sampling and Respondents

Bhattacherjee defines sampling as the statistical method used to select units e.g. people and organisations, from a community of interest for the purposes of constructing observations about that population (Bhattacherjee, 2012). Choosing a sample that represents the population is crucial because when studying the sample, the results are generalized to the chosen population of interest (Bhattacherjee, 2012).

The sampling process is made up of three stages,

1. Defining the population – the population of interest in this study is small medium enterprises operating in South Africa. The unit of analysis in this study is the organisation.

2. Choosing a "sampling frame – a sampling frame is" - a typical subgroup of the population of the unit of analysis (Bhattacherjee, 2012, pg.80)

3. Selecting sample members – A sample is drawn from "the sampling frame using a well-defined sampling technique" (Bhattacherjee, 2012, pg. 66).

Two main categories of sampling techniques are probability and non-probability sampling (Bhattacherjee, 2012). Probability-based sampling technique is when every unit within the population has a non-zero chance of being selected, and the probability of selection can be accurately determined. This technique is used when the findings are to be generalized back to the population, i.e. it provides for higher external validity of the findings (Bhattacherjee, 2012). Simple random sampling is a common probability sampling technique. Non-probability sampling occurs when some units of the population have zero chance of being selected, and the probability of selection cannot be accurately determined (Bhattacherjee, 2012). In this technique, selection of members is subject to sampling bias and thus results from the sample cannot be generalized back to the population (Bhattacherjee, 2012). Convenience and purposive sampling are common non-probability sampling techniques.

For this study, initially, the aim was to strengthen generalisability or external validity. For this purpose, SMEs listed in the Africa Growth Institute (AGI) (available in the web address http://africagrowth.co.za) provided a sampling frame for this study and had been used previously in prior cloud software adoption work (Madisha & Van Belle, 2011). A sample of 200 financial, manufacturing, retail and consulting SME firms was drawn from a randomized list of companies. Unfortunately, it was difficult to secure an adequate number of responses from this sampling frame. Therefore, it was decided to supplement the sample with a non-probability sample. More specifically, convenience sampling was also applied by selecting participants from LinkedIn website based on the role or job title of the participants. LinkedIn website was used to find additional South African SMEs to participate in the study over and above those listed in the AGI. A total of 658 SMEs from AGI and LinkedIn were invited, in addition, 30 SMEs from Tembisa Startup Grind were also invited.

Within each organisation sampled, a single key informant was identified and invited to take part in the study. The selected key informant was considered to be knowledgeable about the adoption and the implementation of cloud-based software solutions in the firm. These included financial manager, operations manager or IS manager within the SME. The use of key informant is typically used to collect data on organisational factors in IS research (Nevo & Wade, 2011)

4.4.4 Questionnaire Administration

For the sample of 658 SMEs obtained from AGI and LinkedIn, the final questionnaire was administered as an online survey using e-survey creator[1]. The link to the survey was embedded into the survey invitation with covering letter (See Appendix B) explaining the purpose of the study, promising anonymity and confidentiality, and stating that participation was voluntary. The email address of the participants was obtained from the Africa Growth website, and other contacts were from LinkedIn social network website. Administering the questionnaire took place over a total of 10 months starting from March 2017. Reminders were sent after every week between November 2017 and January 2018 to those sampled SMEs who had not yet participated.

For the sample of 30 SMEs associated with Tembisa Startup Grind, a paper-based version of the questionnaire was administered and collected over one day.

4.5 Data Analysis Methods

The ultimate goal of this study is to describe factors affecting organisational adoption of cloud-based software solutions; all collected data was statistically evaluated through the use of (SPSS) Statistical Package for Social Sciences analysis tool version 24[2]. The first phase of analysis focused on data validity and reliability. Next, the data was analysed using descriptive statistics to address research question 1. Third, the data was analysed using inferential statistics (hypothesis testing) to address research question 2 and test the research model.

4.5.1. Reliability and Validity

Reliability reflects the accuracy of an instrument (Bhattacherjee, 2012). For example, a participant completing an instrument which is meant to measure adoption should provide a consistent response each time the test is completed (Creswell & Clark, 2007). This study ensured reliability by adopting scales from literature that are free from ambiguity, using simple English wording on questionnaire items and conducting a pilot testing ensuring reproducibility of the questionnaire. In addition, the most commonly used test to determine the internal consistency of an instrument is the Cronbach's alpha. The Cronbach's alpha score must be at least 0.7 for internal consistency to be confirmed (Bhattacherjee, 2012). Validity is explained as the degree with which an idea is legitimately measured within a quantitative study (Creswell, 2007).

In most instances, validity testing is focused on construct validity (Bhattacherjee, 2012). Convergent and discriminant validity are the dimensions of construct validity on which this study focused. This study used principal components analysis (PCA) to establish convergent and discriminant validity.

[1] http://www.esurveycreator.com
[2] https://www.ibm.com/analytics/spss-statistics-software

PCA loadings were used to provide evidence of convergent validity (where items that load highly (above 0.65) onto constructs they are expected to measure) provide evidence of convergent validity. Evidence of discriminant validity is provided when (items load low (below 0.4) onto constructs they are not projected to measure). Once reliability and validity were established then composite scores were calculated for each of the variables for use in subsequent hypothesis testing.

4.5.2. Descriptive statistics

Research question 1 is focused on the present state of SaaS adoption among South African SMEs. To address this question, the data provided on adoption of several SaaS technologies was analysed using frequency counts and percentages and presented using tables and figures. This allowed for a description of the percentage of companies that have adopted, are planning to adopt or have no plans to adopt each of the SaaS technologies such as SaaS ERP, CRM, productivity tools, etc. In addition, organisations were asked to estimate the year they first adopted SaaS technology. This was used to draw a diffusion curve to illustrate the state of SaaS adoption and to depict how far along the diffusion curve SaaS technologies, in general, have advanced within the sampled SMEs. An example of a diffusion curve is shown below:

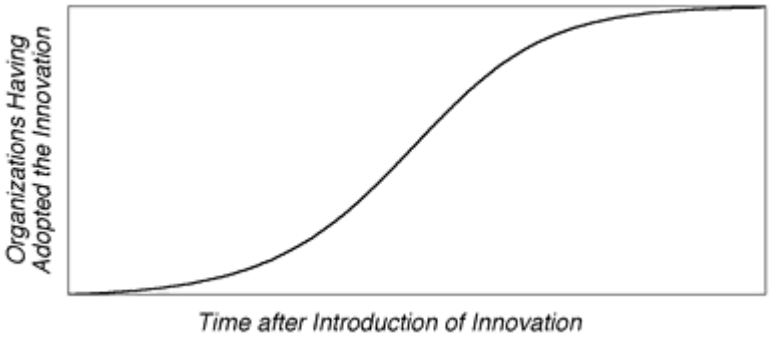

Figure 8: Diffusion Curve

Source: *https://www.nngroup.com/articles/bass-curves-for-the-difussion-innovations/*

4.5.3. Hypothesis testing

Testing an hypothesis consists of the following common steps (Anderson, Sweeney &Williams, 2014):

- Defining the statistical hypotheses (the null and alternative hypotheses)
- Determining the region of acceptance on the null hypotheses (the level of significance).
- Calculating the sample test statistics
- Using the approach of critical value and that incorporates using the level of significance in establishing the important value and the rule of rejection
- Using the "value of the test statistic and the rejection rule to determine whether to reject the" H0.

- Interpretation of the statistical conclusion in the context of the application.

In this study, the hypotheses were defined and stated in Chapter 3. For example, it was hypothesized that greater perceived relative advantage will be positively related to adoption (Hypothesis 1). The null hypothesis being one of no relationship. Multiple regressions were used to test hypotheses. Multiple regressions enable us to anticipate the value of a reliant variable based on other independent variables (Rubin, 2012). In this study, the dependent variable is SaaS adoption, and the independent variables are the TOE factors identified in hypotheses 1 through 12. Before running multiple regression tests, a correlation matrix is usually computed to depict bivariate correlations between pairs of variables (Bhattacherjee, 2012). The correlation coefficients and regression coefficients will be calculated based on data collected.

This study examined the significance of the regression coefficients and also looked at the R-squared to determine if the data is fit with the model. A significance level of alpha=0.05 was adopted for this study such that if $p<0.05$ for a regression coefficient then the corresponding hypothesis will be considered supported, i.e. the null hypothesis of no relationship is rejected.

4.6 Ethical Considerations

An important ethical issue is an informed consent. In informed consent, the individual voluntarily participates in the survey fully understanding the risks and benefits of doing so (Fouka & Mantzorou, 2011). The informed consent should explain the purpose of the study (Fouka & Mantzorou, 2011). The informed consent should also notify the participants about the methods to be used to safeguard their anonymity and confidentiality (Fouka & Mantzorou, 2011). The participant consent form will state that participation is voluntary. The informed consent allows the participants to have full knowledge about the study and withdraw at any time.

Confidentiality and anonymity were also in place during the research. Confidentiality refers to both data and participation. Ensuring data privacy is of utmost importance as low levels of confidentiality could distort results reported. Confidentiality ensures that the information collected is kept private to protect the participants (Fouka & Mantzorou, 2011). Anonymity ensures that the participant's identity is protected and that their responses cannot be linked back to them (Fouka & Mantzorou, 2011). Anonymity and confidentiality ensure that the participants are not penalized or experience prejudice based on their responses.

To ensure informed consent, a cover page with the University logo was attached to the questionnaire (See Appendix C). It described the purpose of the study and highlight that all collected data will be used for research purposes. Participants were well informed that their involvement is voluntary and they can quit from the survey at any given time. It was explained that all responses were anonymous

as no personal identifying information about the respondent or the organisation was requested. Confidentiality was assured as no data will be exchanged with third parties, and results of the study will only be recorded in the aggregate. Ethics clearance was applied for and obtained from the Ethics Committee of the University of the Witwatersrand with the protocol number CINFO/1166 (See Appendix C). Final questionnaire (See Appendix D)

4.7. LIMITATIONS

External validity focus on whether the results can be generalized to the population. To ensure external validity, the researcher needs to discuss the sampling technique used. If the researcher used a sample not representing enough of the population, then the results cannot be generalized to the population. To ensure external validity, the researcher would typically use a sampling method like random sampling that ensures there is no systematic sampling bias (Bhattacherjee, 2012). This study tried to promote external validity by the use of random sampling but also supplemented it with convenience sampling. To the extent that companies were conveniently selected, a systematic bias results, which limits the external validity of the study's conclusions to the population of all SMEs. However, all the companies sampled were SMEs and results are considered to provide a useful description of the state of SaaS adoption and its determinants within a relevant-albeit not representative sample.

Internal validity examines if the recognized change in the control variable is indeed caused by a comparable change in hypothesized independent variable, and not by variables unrelated to the research context (Bhattacherjee, 2012). A researcher must demonstrate that internal validity is considered. To demonstrate internal validity, the researcher would need to show that a cause occurs before the effect, the cause and effect are related and that there are no other alternatives that can be used to explain the relationship of the cause and effect (Bhattacherjee, 2012). This study is cross-sectional and therefore cannot establish the temporal precedence in the data needed to establish causality. Causal inferences can only be made with reference to the theory. Future research can contemplate a longitudinal design to improve understanding of how cloud-based software solutions continue to be adopted and what are the main factors to look for.

Other limitations that are inherent to this study hence arise from the use of the survey design. Specifically, limitations include common method bias and social desirability problem which is common in self- reports as argued by Podsakoff. Data in self-reports are subject to respondent's bias as they may not answer honestly but rather give responses they consider to be more socially desirable. According to Podsakoff (1986), it is also important to be aware of common method bias limitation i.e. that the correlation between two measures has occurred because they are derived from the same source as opposed to occurring naturally (Podsakoff, 1986).

4.8. CHAPTER CONCLUSION

This chapter discussed research methodologies, research paradigm and approach for this study. The chapter focused on research design and strategy, data collection methods as well as measurement and instrument construction that were adopted for this study. The items adopted from literature were also tabled. This chapter also outlined the process followed for pre and pilot testing. The sampling process, as well as sampling techniques used for this study, was also described. Data analysis methods used in this study, strategy for testing reliability and validity was also explained in this chapter. Ethical considerations and limitations related to this study were also presented. The next chapter describes the research findings.

CHAPTER 5: RESEARCH RESULTS

5.1 Introduction

This chapter presents the results for this study. Firstly, data was screened for missing values and outliers. Secondly, the profile of respondents is presented. Next, the chapter answers the first research question by giving a description of the current state of the adoption of cloud-based Software as a Service within South African SMEs. Research question 2 is then addressed by firstly presenting results from reliability and validity tests on the research model's constructs and then testing the hypothesised research model.

5.2 Data Cleaning, Missing Values and Outliers

5.2.1 Data Cleaning

A total of 658 SMEs organisations in South Africa were invited to complete the online survey and a paper-based version of the questionnaire was distributed to 30 SMEs from a group called Tembisa Startup Grind. After ten months of data collection, 119 responses out of 658 (18% response rate) were received from the online survey, and 30 paper-based questionnaire responses were received. The total number of responses received was thus 149.

5.2.2 Missing Data Relevant to Research Question 1

These 149 responses provided complete responses on their organisation's adoption of SaaS technologies relevant to answering research question 1. Within the 149, the forty-eight (48) were respondents who did not provide data on the year of first adoption of any form of SaaS technology. (Table10a). Therefore, the analysis of the diffusion of SaaS (Refer Figure 14) relevant to research question 1 will be based on 149 – 48=101SME firms who provided data on this item.

Table 9 presents the number of missing items per survey question.

Survey Question Number	Total Number of Missing Item Per Question
Q2	48 Missing Values

Table 9: Number of Missing Values per Survey Question No.2.

5.2.3 Missing Data Relevant to Research Question 2

Of the 149 responses, 15 had missing data relevant to answering research question 2. These 15 responses will, therefore, be eliminated, and 134 responses with sufficient data will be used for the

purposes of answering research question 2 (Section 5.5). Within the 134 responses to be used for addressing research question 2, missing data is depicted in Table 10b. Except for question 19, which asked respondents about the year of first establishment of their firm, the other items were Likert scale items measuring the extent of adoption, stage of cloud software adoption, perception of cloud software adoption. There was no obvious pattern to the missing data. Because missing values were assumed to be missing randomly with no specific pattern, missing values were imputed using the series mean for each variable.

Survey Question Number	Total Number of Missing Item Per Question
Q6	1 Missing Values
Q9	1 Missing Values
Q12	1 Missing Values
Q16	2 Missing Values
Q17	1 Missing Values
Q18	1Missing Values
Q19	5 Missing Values
Q20	3 Missing Values
Q21	8 Missing Values

Table 10: Number of Missing Values per Survey Question (other questions except for question No.2)

5.2.4 Outliers

The data for the 134 cases to be used in answering RQ2 was screened with the purposes of identifying any possible outliers. Outliers are determined by the use of the standardised scores technique. The appropriate way of identifying an outlier is through the examination of cases on each questionnaire item where a standardised score is greater or less than +-3. Based on a review of standardised scores recorded, no outliers were identified.

5.2.5 Reverse Coding

The item 3 SC3 – "The security of sensitive information is a major obstacle to your firm using cloud-based software" measured using a 5-point Likert scale was reverse coded. Therefore, high values on the issue of security represented that there was *low* concern about security.

5.3 Response Profile

The sample of 149 responses received is profiled next according to job title, number of employees in the organisation, industry type and number of years spent in the firm.

5.3.1 Response Profile by Job Title

After profiling the respondents according to their job titles, it was found that a majority of respondents were senior IT Managing Directors and some were CIOs and CEOs who are responsible to making IT decisions. Other respondents identified themselves as Project Managers and Business Development Managers who also are responsible for making IT decisions. Table 11 shows a breakdown of respondent job titles.

Job Title	Number of Response
CIO	10
CEO	17
CTO	1
Deputy Director	1
Managing Director	19
Project Manager	4
Sales Manager	2
General Manager	3
Senior Software Developer	2
Group Business Development Executive	1
Business Intelligence Lead	1
Business Development Manager	10
Project Team Lead	3
Assistant Project Manager	7
Research Head (Cyber Security)	1
IT Consulting Director	2

Job Title	Number of Response
VP Cloud Lead	1
SAP Data Engineer	1
Operations Lead	1
SAP Systems Integration Lead	1
Group Specialist: Economic Regulation	1
Director	36
Manager	10
Missing	14
Total	149

Table 11: Respondents by Job Title

5.3.2 Response Profile by Number of Employees

Respondents were asked to indicate the size of their organisation given by the number of employees. Table 12 shows that most respondents were SMEs having less than 150 employees.

Number of Employees in the Organisation	Number of Responses per Participant
Less than 20	55
20 – 49	38
50 - 99	14
100 - 149	11
150 - 199	5
200 – 249	2
>250	0 (given definition of SME)
Missing	35

Number of Employees in the Organisation	Number of Responses per Participant
Total	149

Table 12: Number of Employees in the Organisation

5.3.3 Response Profile by Industry Type

Respondents were asked to indicate the industry in which they believe their organisation can be classified. As per table 13, this study showed representation among different industry types with IT industry showing the highest representation, followed by Business Services and Health Care. Figure 8 graphically depicts the responses per industry type.

Industry Type	Number of Responses per Industry Type
Information Technology	42
Business Services	23
Health care	15
Government	2
Manufacturing	7
Mining	2
Automotive	2
Aerospace	1
Communications	7
Construction	4
Consumer Products	2
Insurance	2
Finance	5
Food Service	2
Education	8

Industry Type	Number of Responses per Industry Type
Transportation	1
Agriculture	3
Real Estate	4
Legal	2
Pharmaceuticals	2
Publishing	2
Utilities	2
Wholesale/Retail	8
Other	1
Total	149

Table 13:Number of responses by Organisation Industry Type

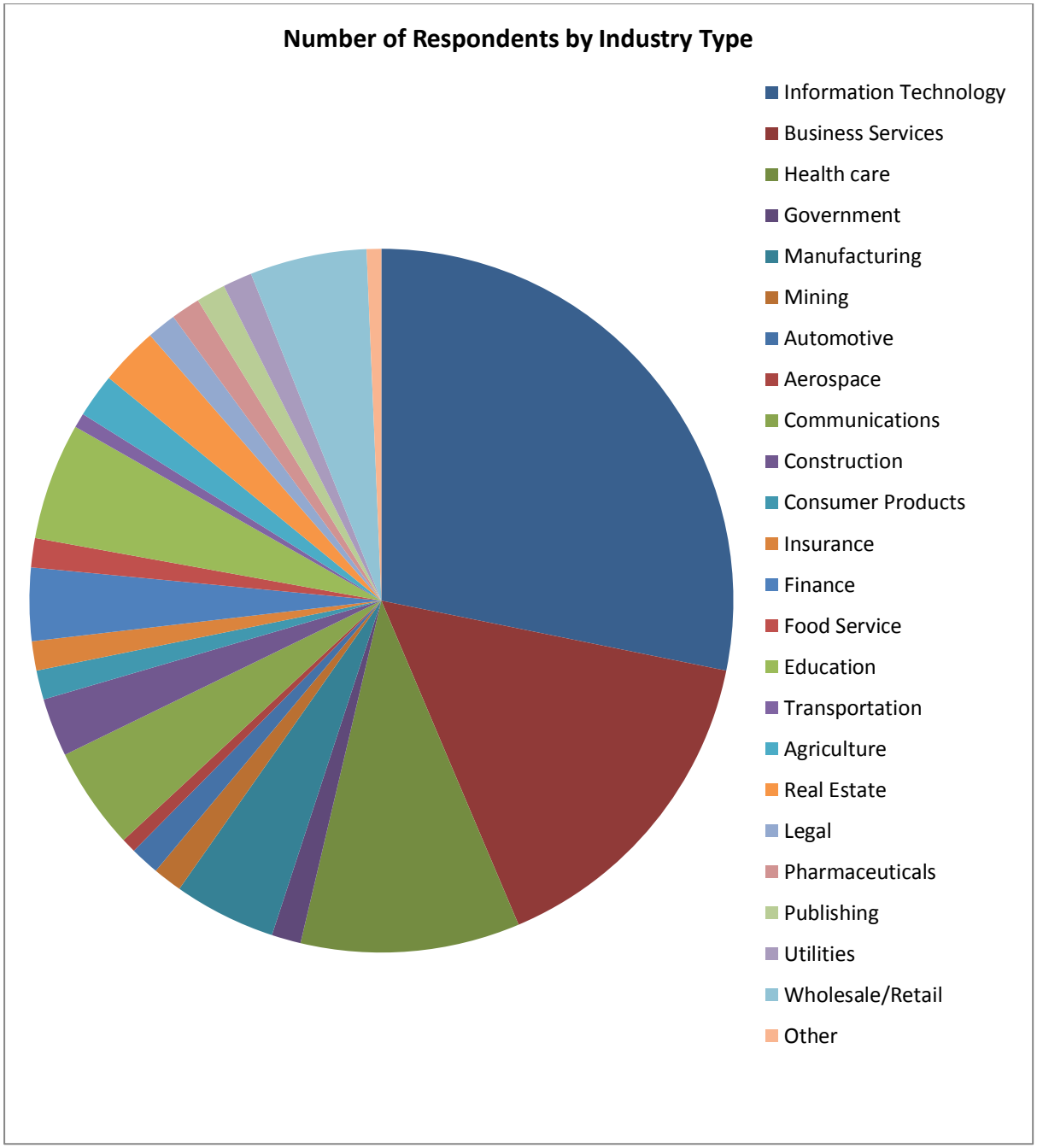

Figure 9: Number of responses by Organisation Industry Type

Research question 1 is addressed next.

5.4 Research Question 1: The current state of cloud-based software solutions (SaaS) as reported by SMEs in South Africa.

5.4.1 Respondents by type of SaaS technology adopted

Respondents were asked to indicate if they have adopted any of the SaaS technologies and if not whether they have plans to adopt. The adoption of each of the SaaS technologies by the 149 responding SME organisations are shown in table 14. Interestingly, it was evident that only 6 of the 149 (4%) indicated that they had adopted all of the below mentioned SaaS technologies.

	We have adopted	**We have not adopted, but we have plans to adopt within the next few years**	**We have not adopted and have no immediate plans to adopt**	**We have not adopted, but are not sure about plans**	**Don't know if we have adopted or not?**	**Missing**	**Total**
1.Cloud ERP e.g. NetSuite	28	16	60	30	14	1	149
2. Cloud CRM e.g. Salesforce	33	18	61	28	8	1	149
3. Cloud e-mail e.g. Gmail	93	21	19	10	5	1	149
4. Cloud productivity tools e.g. Microsoft Office 365	87	25	16	18	2	1	149
5. Cloud financial or payroll tools e.g. QuickBooks Online	26	25	56	29	12	1	149
6. Cloud e-	24	20	55	40	9	1	149

	We have adopted	We have not adopted, but we have plans to adopt within the next few years	We have not adopted and have no immediate plans to adopt	We have not adopted, but are not sure about plans	Don't know if we have adopted or not?	Missing	Total
commerce platform e.g. Shopify							
7. Cloud storage e.g. Dropbox, Google Drive	91	22	16	16	3	1	149
8. Video conferencing e.g. WebEx and Skype	76	18	24	24	6	1	149
9. IT helpdesk/ ticketing e.g. Zendesk, Jit Bit helpdesk	38	10	60	26	14	1	149
10. Virtual team communication. e.g. Slack, Microsoft Teams and Trello	46	10	47	38	7	1	149

Table 14: SaaS technologies adopted

In addition, respondents were asked to indicate their stage of adoption on SaaS technology more generally, without reference to any specific technology. The figure below depicts that 56 % of the organisations already considered themselves to have adopted some form of cloud-based software and 18% have evaluated and plan to adopt SaaS technologies. While 22% are still evaluating, 7% have evaluated but do not plan to adopt any of the SaaS technologies. It is evident that most responding SMEs consider SaaS technologies and important part of their IT portfolio.

The graph below depicts number of different stages of SaaS adoption. Figure 10 depicts that majority have already adopted SaaS technologies.

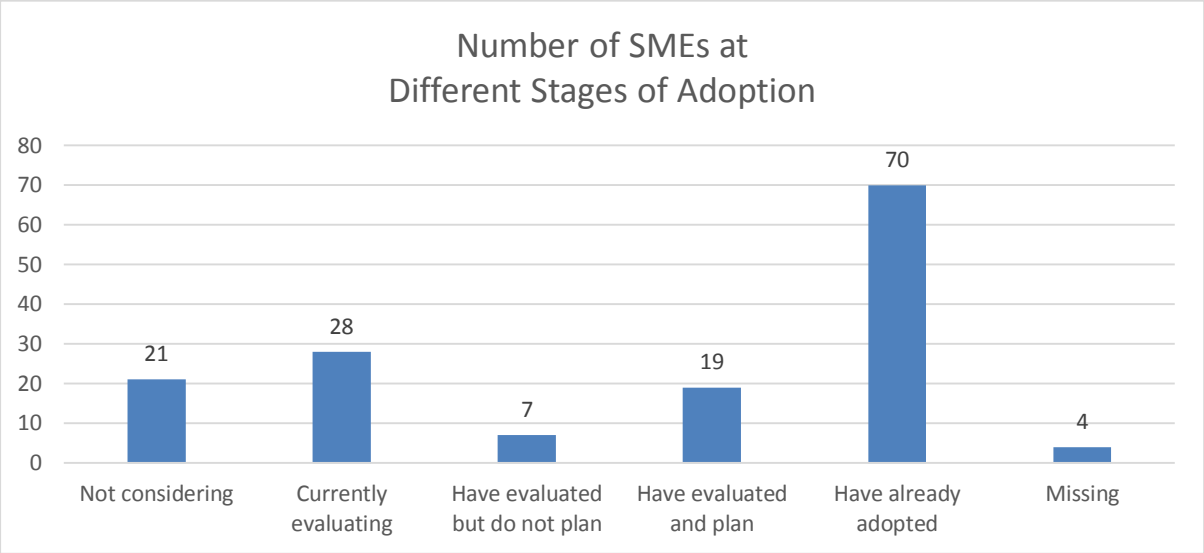

Figure 10: Number of SMEs at Different Stages of Adoption

Figure 11 depicts the percentages of responding firms at each stage of adoption. The figure shows that 18.79% of responding SMEs are still evaluating SaaS solutions. However, 14% have not considered SaaS and nearly 5% have evaluated but rejected SaaS.

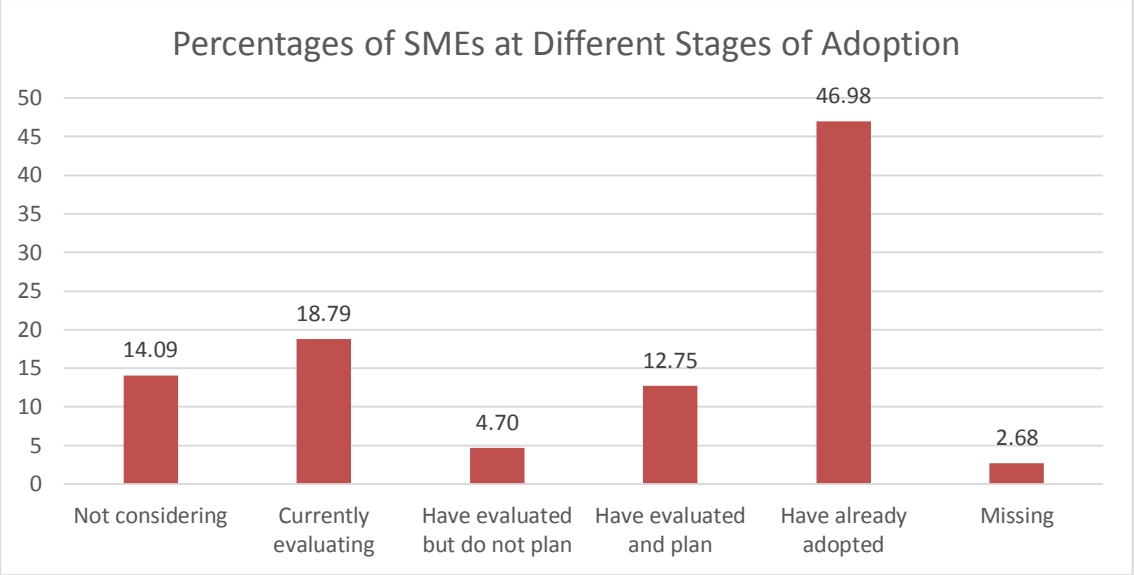

Figure 11: Percentages of SMEs at Different Stages of Adoption

Figure 12 depicts the percentages of different SaaS technologies adopted with Gmail (cloud e-mail), DropBox (Cloud Storage) and Microsoft office 365 (cloud productivity tools) being the highest adopted SaaS technologies followed by WebEx and Skype (video conferencing). After virtual team communication, IT helpdesk ticketing, payroll tools and cloud e-commerce platform are the less diffused SaaS technologies. Few firms have adopted cloud-based solutions to support enterprise processes, financials and payroll. This situation is unlikely to change for a while as few non-adopters report any immediate plans to adopt these technologies. The least adopted SaaS technologies was cloud e-commerce with 13.2%.

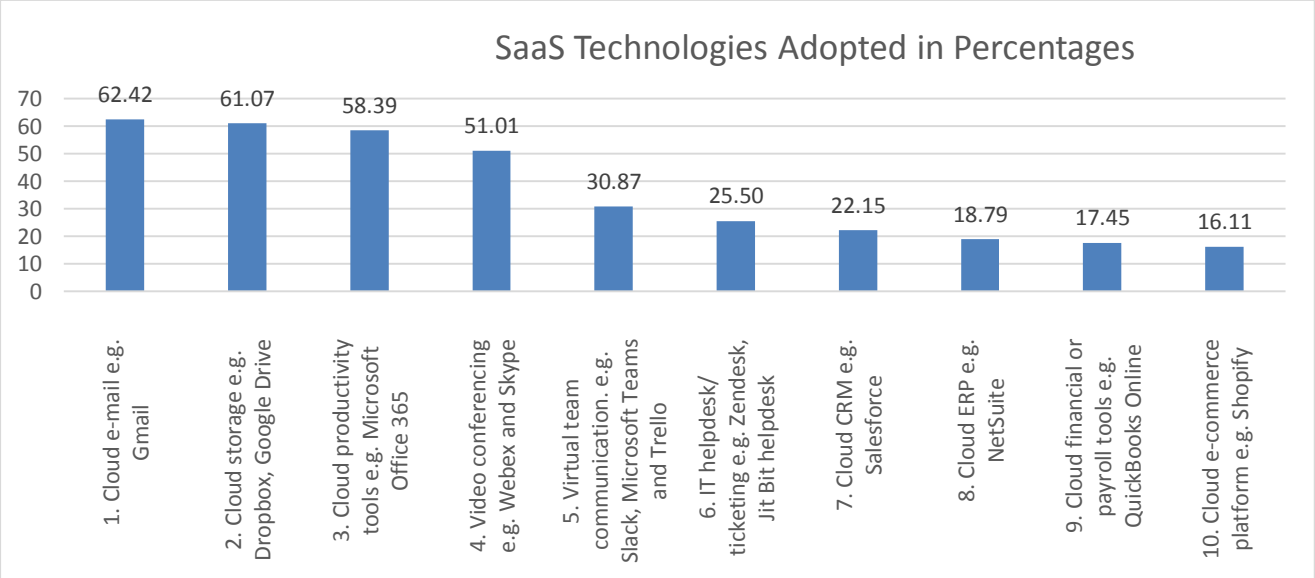

Figure 12: SaaS Technologies Adopted in Percentages

According to Figure 13, 93 out of 149 adopted cloud email (e.g. Gmail) while 24 out of 149 adopted Cloud e-commerce (e.g. Shopify).

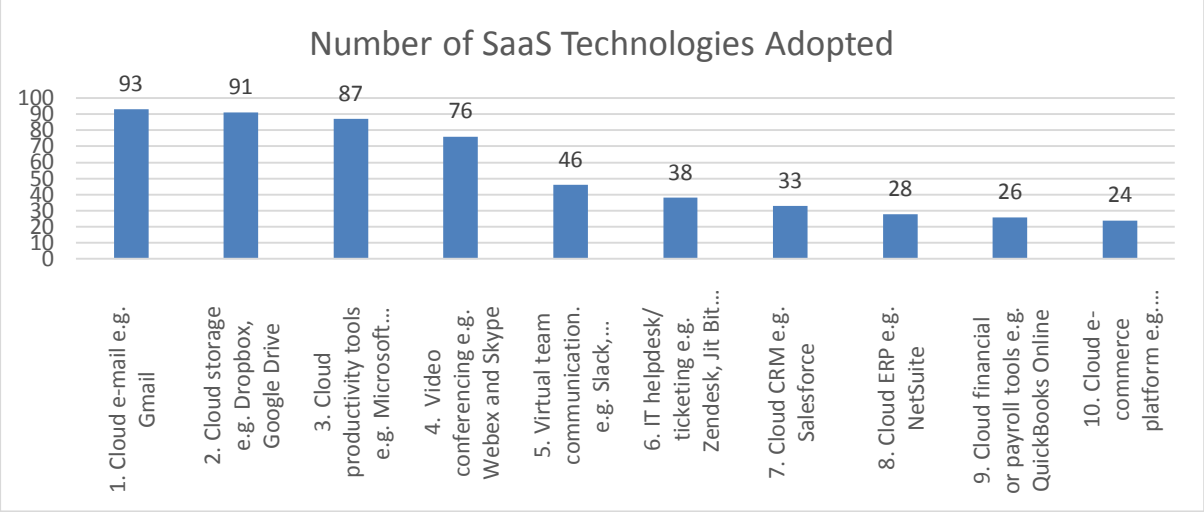

Figure 13: Number of SaaS Technologies Adopted

Respondents were also asked to report the year their organisation had first adopted SaaS. Although many organisations had reported adopting at least one SaaS technology, not every organisation provided data on the year of first adoption. Specifically, 48 of the 149 did not provide the data. The data provided was plotted from the remaining sample of 101 organisations as a cumulative diffusion curve showing the level of adoption overtime. Such curves tend to level off when no new adopters are observed, and the saturation phase is reached. The diffusion curve in Figure 14 depicts the cumulative distribution of SaaS adoption among the responding firms.

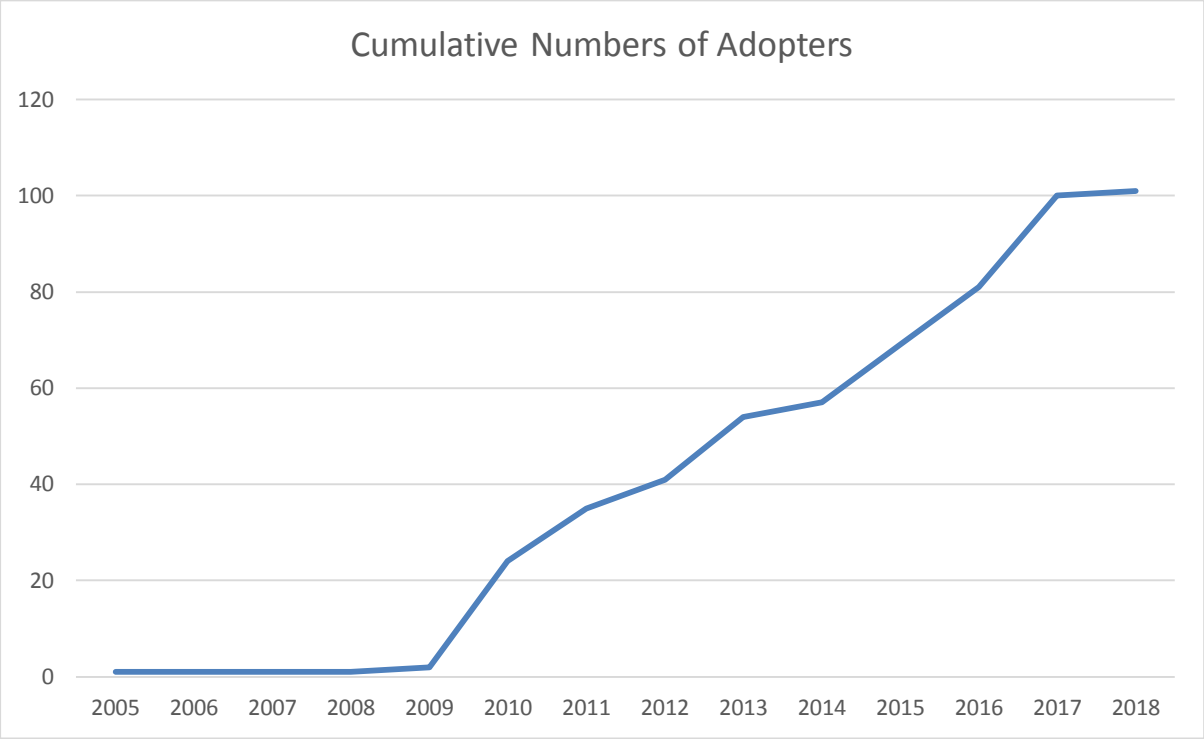

Figure 14: Cumulative Numbers of Adopters

In addition, the below Figure shows the cumulative percentage of adopters over the years. The graphs show the adoption rose steeply between 2009 and 2011, after which growth flattened slightly between 2011 and 2014, and steeply again from 2014 to 2017. Given the timing of data collection, it cannot be concluded that 2018 represents a levelling off. However, the saturation point may be nearing and the remaining first-time adopters within this sample would be classified as "laggard" adopters.

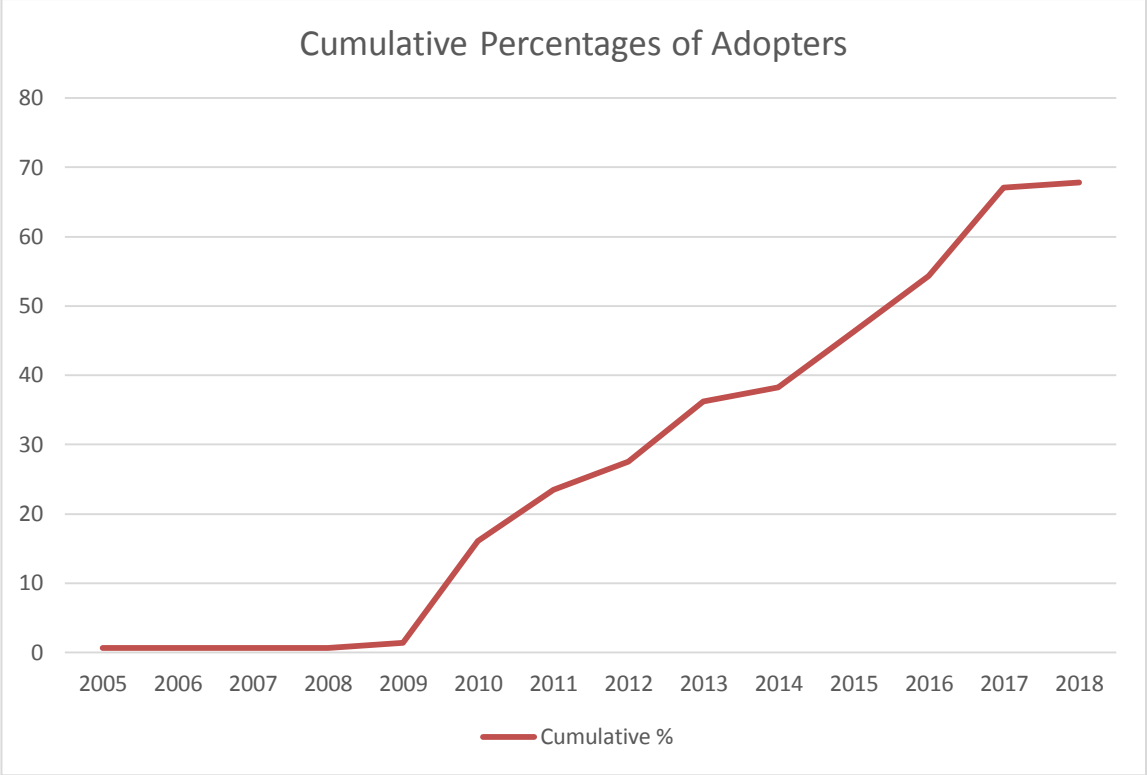

Figure 15: Cumulative Percentages of Adopters

Next, the research question 2 is addressed.

5.5 Research Question 2: Technological, Organisational and Environmental factors perceived to be influencing South African SMEs to adopt cloud-based software solutions (SaaS)

For the purposes of answering research question 2, there were 134 respondents that provided sufficient data. Before hypotheses can be tested to address research question 2, the reliability and validity of the scales used to measure TOE factors had to first be established. Then the research model is tested.

5.5.1 Reliability and Validity Testing

5.5.2 Validity

To evaluate convergent and discriminant validity of the multi-item scale measures, this study used Principal Components Analysis (PCA). The analysis was done on SPSS version 25. For principal components analysis runs, the items were grouped according to the three contexts which are technological context, organisational and environmental contexts for the independent variables. Splitting the PCA analyses was primarily done due to sample size considerations and considered theoretically acceptable based on the underlying TOE framework.

5.5.2.1Technological Context

Each construct under technological context was measured using multi-item scales. To allow an assessment of convergent and discriminant validity, PCA was used with Varimax rotation for technological constructs. Six sets of technological items (complexity, compatibility, relateadvantage, securconcern, trust, cost) were included in the analysis, and those that did not initially load to their respective constructs were dropped (SecurConcern3, Cost3, Trust3, Trust4). PCA was then re-run forcing a six factor solutions. The retained items loaded in a manner that evidenced convergent validity as, items loaded high (>0.60) on the factors that they are intended to measure. Discriminant validity was also established as items loaded low (<0.45) on the factors that they are not intended to measure. For technological six items were analysed in a PCA analysis and items loaded onto a single construct explaining 24.3% of the variance. See the below Table 15 for the loadings.

Rotated Component Matrix[a]						
	Component					
	1	2	3	4	5	6
Complexity1		**.763**				
Complexity2		**.830**				
Complexity3		**.775**				
Complexity4		**.805**				
RelatAdvantage1	**.753**					
RelatAdvantage2	**.777**					
RelatAdvantage3	**.830**					
RelatAdvantage4	**.767**					
RelatAdvantage5	**.795**					
Compatibility1			**.657**			
Compatibility2			**.760**			
Compatibility3			**.738**			
Compatibility4			**.686**			
SecurConcern1				**.859**		
SecurConcern2				**.807**		
Cost1						**.908**
Cost2						**.615**
Trust1					**.832**	

Rotated Component Matrix[a]						
	Component					
	1	2	3	4	5	6
Trust2					**.619**	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 7 iterations.						

Table 15: Rotated Components Matrix for Technological Factor5.5.2.2 Environmental Context

Items measuring the three environmental constructs (mimetic, normative and coercive pressures) were similarly analysed using PCA. Initially, one Mimetic pressure item (MimePres1) was dropped because it did not have any primary loading meaning that it did not load high on any construct. A Coercive pressure item (CoerPress3) was also dropped because it did not load with the other coercive pressure items. Also, Normative pressure and Mimetic pressure items initially loaded onto the same construct. Therefore, it was decided to drop coercive pressure (CoerPress3) and to re-run the PCA forcing a 3 factor solution. The retained items loaded as expected with convergent validity established as, items loaded high (>0.60) on the factors that they are intended to measure and discriminant validity established as items loaded low (<0.45) on the factors that they are not intended to measure. See the below Table 16 for the loadings.

Rotated Component Matrix[a]			
	Component		
	1	2	3
CoerPress1	**.862**		
CoerPress2	**.743**		
CoerPress4	**.723**		
CoerPress5	**.817**		
MimePress2			**.831**
MimePress3			**.840**
NormPress1		**.752**	
NormPress2		**.781**	
NormPress3		**.831**	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

Table 16: Rotated Components Matrix for Environmental Factors

5.5.2.3 Organisational Context

Items measuring the three organisational constructs (geographic dispersion, top management support and cloud software readiness) were next subjected to a PCA analysis. Geographic dispersion construct did not evidence unidimensionality. It was decided that two items be dropped (GeoDisp2 and Geodisp3) and only a single item best capturing the conceptual definition of geographic dispersion (GeoDisp1) was retained. Principal component analysis forcing a 3 factor solution was re-run with GeoDisp1. CloudSoftReadiness2 was dropped because it did not load as expected. The retained items then loaded as expected with primary loadings as per table below. Convergent validity was established as, items loaded high (>0.60) on the factors that they are intended to measure and discriminant validity was established as all but one item loaded low (<0.45) on the factors that they are not intended to measure. TopMansupport1 loaded at 0.5 on component 2 but it had an evident primary loading and the overall factor structure was supported. Table 17 below shows the primary loadings.

Rotated Component Matrix[a]			
	Component		
	1	2	3
GeoDisp1			**.996**
TopManSupport1	**.777**		
TopManSupport2	**.896**		
TopManSupport3	**.840**		
CloudSoftReadines1		**.859**	
CloudSoftReadines3		**.861**	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

Table 17: Rotated Components Matrix for Organisational Factors

Cloud Adoption

For cloud software adoption four items were analysed in a PCA analysis and items loaded onto a single construct explaining 82.8% of the variance. See the table below.

Component Matrix[a]	
	Component
	1
CloudSoftAdop1	.846
CloudSoftAdop2	.911
CloudSoftAdop3	.939
CloudSoftAdop4	.943
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

Table 18: Rotated Components Matrix for Cloud Adoption

5.5.3 Reliability and Descriptive Statistics

To assess reliability of the constructs, Cronbach's alpha coefficient was used as a measure of internal consistency reliability. Reliability of all variables was established as Cronbach's alpha coefficients exceeded 0.70 and most were well above 0.85 evidencing strong internal consistency of the measures. Composites scores for constructs were then calculated as the arithmetic average of the surviving items. The reliability and descriptive statistics for the composites are provided in Table 19 below. The general interpretation of skewness and kurtosis states that skewness must be between ±1 and kurtosis between ±3. Both skewness and kurtosis for all the constructs in Table 19 were observed to fall within the acceptable range.

Construct	Number of Items	Cronbach 's Alpha	Mean	Std. Deviation	Skewness	Kurtosis
Geodisp1	1	N/A	3.56	1.474	-.619	-1.136
Composite Cloud Readiness Software	2	0.922	3.2105	1.19241	-.326	-1.061
Composite Top Management Support	3	0.943	3.3058	1.16410	-.471	-.775

Composite Normative	2	0.891	3.2264	1.05140	-.407	-.623
Composite Coercive	4	0.890	2.9142	1.01266	-.039	-.819
Composite Mimetic	2	0.873	3.3507	1.12228	-.401	-.790
Composite Cost	2	0.764	2.7519	1.07889	.485	-.735
Composite Trust	2	0.869	3.1692	1.11401	-.348	-.898
Composite Relative Advantage	5	0.970	3.7263	1.16373	-.874	-.323
Composite Security Concern	2	0.906	3.2744	1.20691	-.489	-.747
CompositeComplexity	4	0.918	2.7369	1.19220	.494	-.751
CompositeCompatibility	4	0.955	3.4361	1.12459	-.541	-.806
CompositeAdoption	4	0.931	3.1026	1.27410	-.063	-1.258

Table 19: Descriptive Statistics

5.5.4 Correlation Analysis

In order to determine the relationship between independent and dependent variables, and as a first step to test the study's hypotheses, correlation analysis was used. Correlation allows a determination to be made as to whether the relationship is significant or not (i.e. significantly different from zero). Bivariate Pearson correlation was used to establish the relationship between variables. Table 20 below provides correlation coefficient between adoption and the twelve variables drawn from TOE (Geographic dispersion, cloud software readiness, top management support, normative, coercive, mimetic pressure, cost, trust, relative advantage, security concern, complexity and compatibility).

Correlation with Composite Adoption	
CompositeCompatibility	.721**
Composite Complexity	-.503**
Composite Relative Advantage	.666**
Composite Security Concern	.652**
Composite Cost	-.430**
Composite Trust	.638**
Geographic Dispersion (Geodisp1)	.082
Composite Cloud software readiness	.685**
Composite Top Management Support	.703**
Composite Coercive	.642**
Composite Normative	.602**
Composite Mimetic	.462**p

Table 20: Pearson Correlation (**p<0.001)

The correlation reflects that statistical significant correlations were found between adoption and 11 of the TOE variables:

- Compatibility and cloud adoption (r = 0. 721, p<0.001)
- Complexity and cloud adoption (r = -0. 503, p<0.001)
- Relative advantage and cloud adoption (r = 0. 666, p<0.001)
- Security concern and cloud adoption (r = 0. 652, p<0.001)
- Cost and cloud adoption (r = -0. 430, p<0.001)
- Trust and cloud adoption (r = 0. 638, p<0.001)
- Geographic dispersion and cloud adoption (r = 0.082, p<0.345 – not significant)
- Cloud software readiness and cloud adoption (r = 0. 685, p<0.001)
- Top management support and cloud adoption (r = 0. 703, p<0.001)
- Coercive pressure and cloud adoption (r = 0. 642, p<0.001)
- Normative pressure and cloud adoption (r = 0. 602, p<0.001)
- Mimetic pressure and cloud adoption (r = 0. 462, p<0.001)

The relationship between cloud adoption and geographic dispersion is not statistically significant. A negative correlation is reflected between complexity and cloud adoption as well as between cost and cloud adoption. Because security concern was measured such that high values reflected low levels of concern, the positive correlation is expected.

5.5.5 Regression Analysis

Given the number of statistically significant correlations that were observed between cloud adoption and TOE variables, it would be useful to understand their combined and relative effects, which is something best achieved through conducting a regression analysis. Regression analysis was conducted to regress the dependent cloud adoption variable on the TOE factors. Three sets of regressions were initially run. First, the technological were considered separately in a multiple regression. Second, the organisational factors were considered separately. Third, the environmental factors were considered separately. Then a fourth, stepwise regression to examine which from all the TOE factors was run to examine all the TOE factors to determine which would account for the majority of variance.

Technological Factors

Table 21 shows the regression analysis summary output for the technological factors.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.774 a	.599	.580	.82589

Table 21: Technological Factors Regression Analysis

From Table 21, it is evident that technological factors are important with the R Square of .599. This was significant at the $p<0.001$ level. Standardised beta coefficients are indicated in Table 22 for the six technological factors.

Model		Standardized Coefficients	t	Sig.
		Beta		
1	(Constant)		-.702	.484
	CompositeComplexity	.127	1.385	.169
	CompositeCompatibility	.409	3.646	.000
	CompositeRelativeAdvantage	.132	1.180	.240
	CompositeTrust	.64	.676	.500
	CompositeCost	-.091	-1.195	.234
	CompositeSecurityConcern	.307	3.278	.000

Table 22: Regression Coefficients for Technological factors

The R-squared of the model regressing adoption on the six technological factors is 59%, which is significant at $p<0.001$ level. The technological factors thus explain nearly 60% of the variance in adoption. Of the six, compatibility ($\beta=0.409$, $p<0.001$) and security concern ($\beta=0.307$, $p<0.001$) are the most significant factors.

Organisational Factors

Table 23 shows the regression analysis summary output for the organisational factors.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.733a	.537	.526	.87700

Table 23: Organisational Factors Regression Analysis

From Table 23, it is evident that organisational factors are important with the R Square of .537. This was significant at the $p<0.001$ level. Standardised beta coefficients are indicated in Table 24 for the three organisational factors.

Model		Standardized Coefficients	t	Sig.
		Beta		
1	(Constant)		1.484	.140
	GeoDisp1	-.018	-.288	.774
	CompositeTopManSupport	.436	4.335	.000
	CompositeCloudSoftReadiness	.339	3.410	.001

Table 24: Regression Coefficients for Organisational factors

The R-squared of the model regressing adoption on the three organisational factors is nearly 54%, which is significant at $p<0.001$ level. Of the three, top management support ($\beta=0.436$, $p<0.001$) is the most significant factor. Cloud software readiness was also significant at the $p<0.01$ level.

Environmental Factors

Table 25 shows the regression analysis summary output for the environmental factors.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.681a	.463	.451	.94419

Table 25: Environmental Factors Regression Analysis

From Table 25, it is evident that environmental factors are important with the R Square of .463. This was significant at the $p<0.001$ level. Standardised beta coefficients are indicated in Table 26 for the three environmental factors.

Model		Standardized Coefficients	t	Sig.
		Beta		
1	(Constant)		1.191	.236
	CompositeCoercive	.442	4.846	.000
	CompositeMimetic	-.036	-.386	.700
	CompositeNormative	.323	3.276	.001

Table 26: Regression Coefficients for Environmental factors

The R-squared of the model regressing adoption on the three environmental factors shows that the environmental factors explain 46% of the variance in adoption, which is significant at $p<0.001$ level. Of the three, coercive ($\beta=0.442$, $p<0.001$) is the most significant factor while normative pressure is also significant for adoption.

Technological, Organisational and Environmental (TOE) Factors

While the above analyses provide an indication of the effects of the technological, organisational and environmental factors separately, it is still necessary to understand their relative effects. Therefore, a stepwise regression was conducted to determine which TOE factors are the most significant factors. The factors that are less significant for adoption are excluded from the stepwise regression procedure with only the most significant factors retained. Table 27 below shows the results of the stepwise regression. The results suggest that of all TOE factors, the most significant one is compatibility then followed by security concern and top management support and then coercive pressures. The conclusion from these results is that at least one factor from across each of the technological, organisational and environmental context is important to cloud adoption. Amongst the technological, the most important once are compatibility and security concern while amongst organisational, the most important factor is top management support and amongst environmental, the most important one is coercive pressures. Together, 63% of variance in adoption is explained.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.294	.247		1.191	.236
	CompositeCompatibility	.817	.068	.721	11.971	.000
2	(Constant)	-.015	.238		-.065	.948
	CompositeCompatibility	.506	.091	.447	5.540	.000
	CompositeTopmanSupport	.417	.088	.381	4.720	.000
3	(Constant)	-.177	.236		-.749	.455
	CompositeCompatibility	.417	.093	.368	4.491	.000
	CompositeTopmanSupport	.311	.092	.284	3.396	.001

	CompositeSecurityConcern	.250	.079	.237	3.174	.002
4	(Constant)	-.284	.240		-1.187	.237
	CompositeCompatibility	.336	.100	.297	3.346	.001
	CompositeTopmanSupport	.222	.101	.203	2.196	.030
	CompositeSecurityConcern	.271	.079	.256	3.444	.001
	CompositeCoercive	.210	.106	.167	1.983	.050
a. Dependent Variable: CompositeAdoption						

Table 27: Stepwise Regression for TOE

5.6 Chapter Conclusion

This chapter presented the study's results. Data was screened for missing values, outliers and a profile of sample was then presented. The first research question was addressed by presenting descriptive statistics and a diffusion curve on the state of cloud-based software solutions adoption by SMEs in South Africa. It was shown that cloud-based email, storage and productivity software were the most adopted technologies among SMEs studied, but cloud ERP is not yet well diffused. To address research question 2, reliability and validity of measures was then examined. Correlation and regression analyses were carried out before running final stepwise regression as a basis for supporting or not supporting the study's hypotheses. Table 28 below provides a summary of the results. The results showed that of all TOE factors, the most significant one is compatibility then followed by security concern then top management support and coercive pressures.

Variable	Correlation	Multiple Regression	Stepwise Regression
Technological			
H1:Complexity	**Supported**	Not Supported	Not Supported
H2: Relative Advantage	**Supported**	Not Supported	Not Supported
H3:Compatibility	**Supported**	**Supported**	**Supported**
H4:Security Concern	**Supported**	**Supported**	**Supported**
H5:Cost	**Supported**	Not Supported	Not Supported
H6:Trust	**Supported**	Not Supported	Not Supported

Variable	Correlation	Multiple Regression	Stepwise Regression
Organisational			
H7:Geographic Dispersion	Not Supported	Not Supported	Not Supported
H8:Top Management Support	**Supported**	**Supported**	**Supported**
H9:Cloud Software Readiness	**Supported**	**Supported**	Not Supported
Environmental			
H10:Mimetic Pressures	**Supported**	Not Supported	Not Supported
H11:Coercive Pressures	**Supported**	**Supported**	**Supported**
H12: Normative Pressures	**Supported**	**Supported**	Not Supported

Table 28: Summary of Results

CHAPTER 6: DISCUSSION OF RESULTS

6.1 Introduction

This chapter presents the findings of this study. The aim of this research study was to describe the state of cloud-based software (SaaS) adoption among South African SMEs, and to investigate the factors affecting their adoption of SaaS solutions. Specifically, two research questions underpinned this study, the first research question aimed to discover the current state of cloud-based software adoption. The second research question aimed to identify the technological, organisational and environmental factors that promote or inhibit adoption.

Data from 101 SMEs was available to address the first question, and data from 134 SMEs organisations was used to test the hypotheses related to research question 2. The results of the analyses were presented in the previous chapter. A further discussion of those empirical results is presented in this chapter. The results are interpreted and related back to literature and theory. This chapter draws together a discussion of the empirical findings of the effects on adoption of the TOE factors drawn inter-alia from Institutional Theory and DOI.

6.2 Research Question 1: What is the current state of cloud-based software solutions (SaaS) as reported by SMEs in South Africa?

Cloud solutions consist of Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) (Salesforce, March 2018). Software as a Service is one component defined as a "software delivery model in which services are installed, assembled and maintained on the systems of the SaaS provider and used by others over the internet" (Janssen & Joha, 2011, pg.4). In general, cloud software can offer SMEs a number of potential benefits including flexible monthly instalments, (Fassen, Seymour & Schuler, 2013) simplified operations and significant cost reduction. The pay-as-you-go pricing model allows for quick roll out and returns on investments, while automatic updates and patches to the software can occur without disrupting the organisation (St. Clair, 2008). Another attractive SaaS component is that it permits access from any geographical location given that SMEs employees often work outside the actual office location and having easy access of their data using mobile devices would be a benefit (Gupta et al, 2013; McAfee, 2011).

Some prior work had examined and explored the factors driving the adoption of cloud-based services (Lal & Bharadwaj, 2016). However, past work had not potentially explored a large number of factors affecting adoption of cloud-based software and these factors need to be explored further, in particular technological, organisational and environmental factors (Bhattacherjee & Park, 2014; Pishad et al. 2014). For the purposes of this study, a basket of cloud-based software solutions (SaaS) was identified and included the following, cloud ERP, cloud CRM, cloud e-mail, cloud productivity tools, payroll tools, cloud e-commerce, cloud storage, video conferencing, IT helpdesk ticketing and virtual team

communication. These solutions were identified based on a review of past works. Cloud ERP is an approach to enterprise resource planning (ERP) that make us of cloud computing platforms and services to provide a business with more flexible business transformation(http://www.gartner.com/it-glossary/clouderp), cloud CRM is a customer relationship management software hosted in the cloud (http://www.gartner.com/it-glossary/cloudcrm), cloud productivity tool is a cloud-based platform that allows teams to work together seamlessly, on multiple projects from remote locations(www.itnewsafrica.com/2017/07/remote-working), payroll tool is the type of SaaS solution where data is processed and allow employees in the other departments, remote or branch office to access the same payroll data and the same software version (http://financialforce.com/resources/what-is-cloud-accouting), cloud ecommerce refers to outsourcing of servers remotely hosted on the internet for the use of application services to store and process data (https://virtocommerce.com/glossary/com-ecommerce-solution), cloud storage is a service model where by data is maintained and managed and backed up remotely and made readily available for the users (https://searchstorage.techtarget.com/definition/cloud-storage), video conferencing is a live, visual connection between two or more people based in separate locations mainly for the purposes of communications (https://searchstorage.techtarget.com/definition/video-conferencing), IT help desk ticketing is a ticketing systems that manage and centralises all the IT tickets (https://www.webhelpdesk.com/ticketig-system), virtual team communication refers to a technology people use to communicate with one another when they can't be face to face (https://www.techwalla.com/articles/what-is-virtua-communication-technology).

The survey asked SMEs to indicate which solutions, out of the basket of cloud-based software solutions (SaaS), they had adopted and which ones they had not adopted. The data collected was aimed to discover the extent to which cloud-based software was adopted. The most adopted solutions were cloud e-mail, cloud storage and cloud productivity tools. The least adopted were virtual team communication, IT helpdesk ticketing, cloud e-commerce and payroll tools. The rank order lists of most to least adopted solutions are:

1. Cloud e-mail (62%)
2. Cloud storage (61%)
3. Cloud productivity tools (58%)
4. Video conferencing (51%)
5. Virtual team communication (30%)
6. IT helpdesk (25%)
7. Cloud CRM (22%)
8. Cloud ERP (18%)
9. Cloud financial (17%)
10. Cloud e-commerce (16%)

The general sense is that while some cloud-based software solutions are well diffused, others are not. For example, cloud ERP offers potential benefits such as the ability to manage accounting, purchasing, sales and other business functions from a single, integrated online solution (Fassen, Seymour & Schuler, 2013). Yet such software was among the least adopted. Moreover, less than 18% of firms indicated that an intention to adopt such solutions. Given the potential of cloud solutions to offer benefits, it remained an open question as to what factors might promote or inhibit such adoption.

The study's second research question aimed at identifying the possible set of factors perceived to be influencing South African SMEs to adopt cloud-based solutions. To this end, the study drew on the technology, organisation and environment (TOE) framework .The next section discusses the TOE factors influencing adoption.

6.3 Research Question 2: What are the technological, organisational and environmental factors perceived to be influencing South African SMEs to adopt cloud-based software solutions (SaaS), and what are their relative effects on adoption?

6.3.1 Technology, Organisation and Environment (TOE)

This study's second research question was to identify TOE factors perceived to be influencing South African SMEs to adopt cloud-based solutions. This study drew on TOE factors and those factors were; technological (complexity, compatibility, relative advantage, security concern, trust and cost), organisational (geographic dispersion, top management support, cloud readiness software) and environmental (mimetic, coercive and normative pressures). A model was also developed based on TOE factors. Twelve hypotheses were developed and examined. There were six technological factors and of the six, two were the most important (compatibility and security concern). There were three organisational factors and of the three, one was the most important (top management support). There were three environmental factors and of the three one was the most important (coercive pressure). These top five most important factors driving adoption are discussed in detail next.

6.3.2 Compatibility

Compatibility is defined as an extent which the technology is viewed to be in line with the current and the essential needs of the firm planning to adopt an innovation (Chong & Chan, 2012). Compatibility is also viewed as the fit between SaaS solutions and the processes and information processing needs of the SMEs (Martins et al. 2016). It was hypothesised to influence adoption because SMEs which perceive greater compatibility in cloud-based software solutions are more likely to adopt it. Compatibility was found to be the most significant factor within technological factor in the stepwise

regression analysis. Firms should therefore evaluate the fit of cloud solutions and their needs prior to adoption. The use of cloud-based software must be compatible with existing hardware and software in the organisation and with business operations and corporate culture.

6.3.3 Security Concern

Security concern was found to be another significant factor among the set of technological factors. Studies conducted by Safari (2015) and Subashini and Kavitha (2011) demonstrate that security was the primary area of concern for organisations adopting cloud-based software. The recent study by Akande and Van Belle (2014) also pointed out that within higher education security is also one of the biggest challenges with regards to cloud adoption. This is because where firms doubt that their sensitive firm's personal information is not protected and can be hacked during transactions (Salisbury, Pearson, Pearson& Muller, 2001) they will not adopt cloud-based software. Results of this study show that the security of sensitive information is an important consideration for firms in adoption of cloud-based software. This finding suggests that in addition to compatibility, firms must first be convinced by cloud vendor's ability to alleviate security breaches, and then they are more likely to adopt (Bhattacherjee & Park, 2014). SMEs must be convinced that data in cloud-based software is protected from those who should not have access to it and safeguarded from unauthorized changes and use.

6.3.4 Top Management Support

Top management support was defined as guidance provided by senior management with an organisation to the allocation of resources and the service integration within the firm (Chong & Chan, 2012). Support from top management was found elsewhere to play vital a role in IT adoption in that top management leadership can stress the role of innovation within the organisation and the importance of the innovation to subordinates (Tushman & Nadler, 1986). Cohen et al. (2014) show top management as the most important positive factor affecting cloud adoption. In addition, Binkkemper (2016) found out that the support from top management is the strongest enabler for SaaS adoption.

Gutierrez argues that top management support is vital to ensure appropriate resources, for example, technical expertise, can be acquired to adopt cloud services (Gutierrez et al., 2015). Top management support is also needed for facilitating a successful change process that may be necessitated by the introduction of new ways of working brought by the innovation (Zmud, 1984). Results of this study confirms that, top management within SMEs must be brought on board and involved early in the decision process to ensure their support and commitment for the firm resources and changes that may be required by cloud adoption. Ensuring top management is aware of the benefits from cloud-based software is also important.

6.3.5 Coercive Pressures

Coercive pressures are defined as official forces utilized on an organisation by other organisations upon which they are dependent (Dimaggio & Powell, 1983). Literature suggests that organisations experience coercive pressures from root corporations, in addition to resource dominant trading partners (Teo, Wei & Benbasat, 2003). Lechesa found environmental factors to be the key factor influencing the decision to adopt cloud-based solutions in South Africa (Lechesa et al. 2012). Coercive pressures were hypothesised to influence adoption because it was found to emanate mainly from the leading suppliers and leading customers (Teo et al. 2003). Similar pressures may promote SaaS adoption. Results from this study contradict those of Cohen, Mou and Trope (2014) who suggested that coercive pressures were less likely to influence adoption. However, unlike their study, this study has examined SMEs who may be more subjected to pressures from trading partners and organisations on which they depend. SMEs must consider that they may not retain their important customers without adopting cloud-based software. In addition, SMEs must take into account that competitive conditions require their firms to use cloud-based software and that customers that matters to them expect them to use cloud-based software.

6.3.6 Other Factors

This study's contribution lies as much in the factors supported as those not supported.

A brief discussion on the factors not found to be as important to adoption is warranted. It was initially thought that four other technological factors would be important to adoption. These were trust because firms need to know that it is critical to choose a trust worthy cloud provider, costs because firms need to know that the cost of an innovation has numerous elements extending beyond initial speculation costs through to operational expenses and the cost of preparing clients to utilize the development of the cloud-based solution. Other factors such as complexity, relative advantage were also hypothesised as determinants of adoption.

While positive correlations were observed and these factors are important, they are not the primary considerations. For example, it may be possible for an SME to overcome issues of complexity if there is greater compatibility with existing software and operations and when there is sufficient top management support. For example, top management support can ensure appropriate resources and technical expertise, can be acquired to adopt cloud services (Gutierrez et al., 2015). Relative advantage may not materialise unless solutions are secure and can be implemented in a manner compatible with the organisation's corporate culture, business operations, value system and fits the workstyle of the organisation. It seems also that adoption is more rational, as environmental factors

such as mimetic pressure were not as important as more direct pressures from customers and trade partners. Surprisingly, it was thought that organisations that operate across a large number of branches or sites require greater need for cloud software to support mobility and to perform task in various locations. The results of the study suggests that adoption of cloud solutions like email, productivity tools and cloud storage are relevant solutions for SMEs regardless of geographic scope of operations and mobility requirements and offer benefits aside from support geographic dispersed operations.

Taken together, the results showed that all the technology, organisational and environmental contexts are all influential in SaaS adoption (Safari et al. 2015). The results support findings by others that, technological, organisational and economic drivers are important discussions in cloud adoption decision made by SMEs (Salum & Rozan, 2015). However, the relative effect of specific TOE factors may differ from other innovation adoption contexts.

6.4 Chapter Conclusion

This chapter discussed the study's results as regards to research question 1 and research question 2. The most adopted SaaS technologies are cloud email. Overall, technological, organisational and environmental factors are all important collectively to the cloud adoption decision. Without top management support, infrastructure compatibility and without addressing the security concerns we are not likely to see adoption and interestingly, there is a bit of coercive pressures in place where adoption is occurring.

CHAPTER 7: CONCLUSION

7.1 Summary of the study

The purpose of this study was to describe the state of cloud-based software (SaaS) adoption among South African SMEs, and to investigate the factors affecting their adoption of SaaS solutions. The technological, organisational and environmental (TOE) factors influencing cloud-based software adoption within SMEs were identified through a review of existing TOE literature. In addition, institutional theory and diffusion of innovation theory were also used to underpin the study. A research model hypothesising the outcome of the identified TOE factors on the adoption of cloud-based software was developed and tested. Specifically, factors hypothesised to influence SaaS adoption were compatibility, security concern, top management support and coercive pressures.

This study employed a relational, quantitative research approach. A structured questionnaire was developed and administered as an online survey. Data was collected from a sample of small and medium enterprises (SMEs) from South Africa that provided useable responses. The collected data was used to firstly describe the state of adoption. Secondly, the extent to which various TOE factors impact on adoption was examined through the use of correlation and multiple regression. It was found that compatibility, security concern, top management support and coercive pressures influence adoption while trust, cost, relative advantage, complexity, geographic dispersion, normative and mimetic pressures did not have significant effects over and above the other factors.

7.2 Contributions to Practice

This study provides information on the current state of adoption for cloud-based software within SMEs in South Africa. In particular, cloud email, cloud storage and cloud productivity tools offer a clear value proposition for SMEs and they are becoming well diffused. Cloud ERP is surprisingly less well adopted and this requires consideration by vendors and future research. These results provide a benchmark for SMEs on where their organisations stand compared to other organisations with regards to SaaS adoption (for example whether they are lagging behind, they are on par, or whether they are innovators). This could inform their IT procurement decisions, as to whether to consider cloud-based software solutions is strategic and necessary to keep abreast with peers and competitors.

Organisations can also learn from the results of this study about the factors contributing to this adoption. For adoption to occur, technological, organisational and environmental factors must be taken into consideration. Specifically, to drive cloud adoption, SMEs need top management support to allocate adequate resources and support the adoption while realising the benefits of cloud-based software. Adoption will also require that cloud vendors and software providers address security concerns and are able to convince potential adopters that sensitive data is protected from those who should not have access to it. Compatibility is an important consideration when evaluating between

alternate cloud software solutions. SMEs must assess both infrastructure compatibility and compatibility with operational processes and organisational culture.

7.3 Contributions to Research

In addition to its practical contribution, this study adds value to the Information Systems literature as it uses TOE framework alongside institutional and diffusion of innovation theory to explain the adoption cloud-based software solutions by South African SMEs. Although several studies researched some of the factors impacting cloud-based software adoption such as cloud ERP (Salleh, 2012; Salim, 2013; Garg & Stiller, 2015), these studies have not examined the effects of a comprehensive set of factors drawn from theory. Salim (2013) argues that within technology adoption, constructs must be selected from multiple theories to develop new integrated theories (Salim, 2013).

Past studies have only recorded the factors influencing cloud enterprise system adoption and tend to forget that the adoption of cloud-based software solutions happens within organisations and therefore the environment of the organisation as well as the technology being adopted play a vital role (Salleh, 2012). This study thus tackles a research gap by combining three theoretical models to enhance our understanding of the factors affecting organisational adoption of cloud-based software solutions and impart knowledge regarding the current state of adoption for cloud-based software within SMEs in South Africa.

This study has shown that TOE framework can be used to arrive at an answer as to the factors that are driving the adoption because as identified from the stepwise regression analysis, factors from across the technological, organisational and environmental contexts emerged as important. Other interesting theoretical contributions arise from hypotheses not found to be supported. For example, complexity was not a primary determinant. Future work may wish to theorise that issues of complexity can be overcome in the presence of top management support and greater compatibility. Such theory can be tested with new dataset. Moreover, relative advantage was found less important than factors such as security and coercive pressures. This influences how we think about software benefits and firm motivations. For example, advantages may not materialise if there are significant security risks, and external influences on firms may be more important in certain cases to adoption than internal cost/benefit analyses. This also warrants consideration in future studies.

This study has also introduced measures for constructs and therefore other studies can use this study's measures in future technology adoption research.

7.4 Limitations and Suggestions for future Research

A large sample with data collected from across South Africa and even other developing countries may provide a more generalisable set of results. Nonetheless, data was collected from a fairly large number of SMEs in South Africa, and we learn a good deal from this study's sample about adoption.

Because this study was a cross-sectional survey and relied on correlation and regression, the temporal precedence and causal relationships are not established in the data. Therefore, causal inferences are made only with reference to theory. Longitudinal work would be needed to trace through cause-effect relationships such as between top management support and adoption.

Also, TOE was drawn upon and only a selected set of factors were examined. Guidance for future research is to explore other TOE factors to study adoption and to consider other influences on adoption behaviour. For example, the experience and technical knowledge of SMEs managers was not considered and may be an important factor for adoption.

Also, because this study was a cross-sectional survey design, the rich experience of specific SME case organisations in the adoption and use of cloud software was not presented. Future work could carry out a case study of SMEs to learn more about their cloud adoption decision processes and experiences with implementation and use. There is also an opportunity to explore some of the factors in greater depth. For example, security considerations are important and future work may wish to explore cloud security from both technical and behavioural and managerial perspective so as to provide greater guidance for SMEs considering adoption.

7.5 Conclusion

Cloud-based software promises to allow users to take advantage of the latest software advances. However, its adoption amongst SMEs within South Africa is uneven. This study sought to determine the critical factors important to adoption, and as the results of the study, we now know that top management support, compatibility of software with infrastructure and operations, and security considerations are the three most important factors driving adoption.

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APPENDIX A: Variables Measures

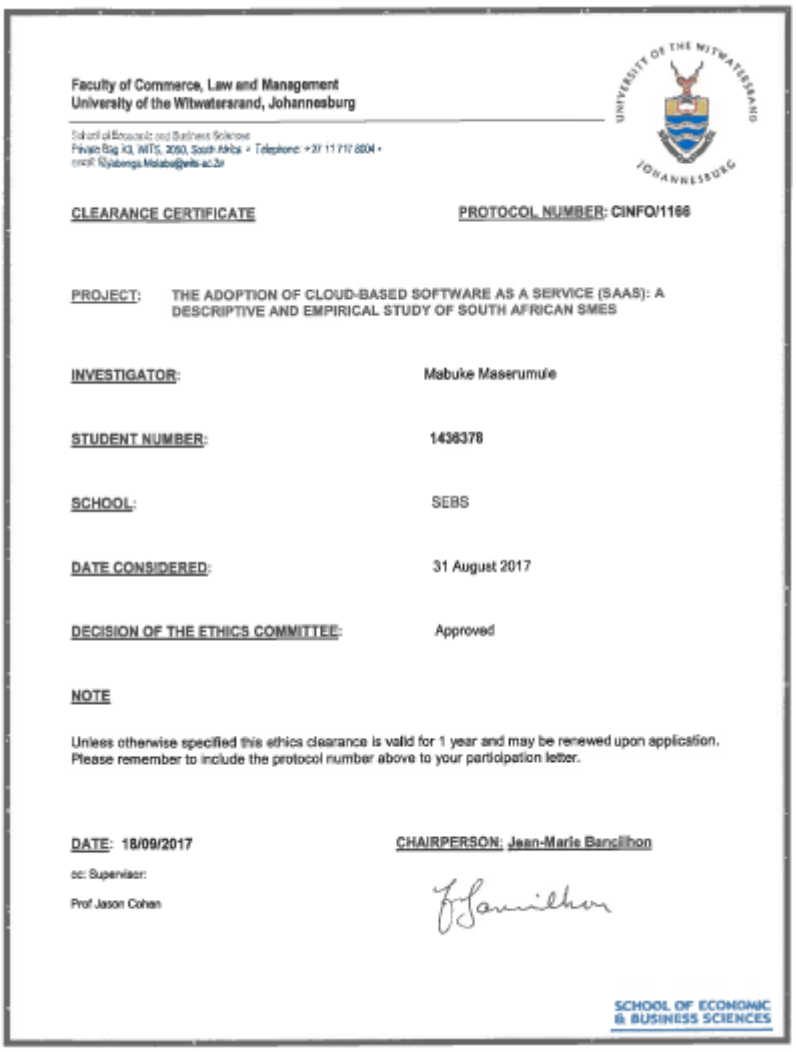
Variable	Conceptual Definition	Example Item (Measures)	Number of items	Literature Reference
Complexity	The degree on which an innovation organisation improvement will be recognized as extreme to utilize.	The use of cloud-based software will be complicated for our organisation to use	4	Oliveira et al., 2014
Relative Advantage	The degree to which a technology innovation is identified to bring benefits to the organisation	The use of cloud-based software will improve quality of operations	5	Oliveira et al., 2014
Compatibility	The degree will which an improvement is observed Similarly as steady for those existing values, needs, and previous encounters of the possibility adopter.	Cloud-based software is suitable for our current systems, business process, and operations	4	Chong & Chan, 2012
Security Concern	The degree to which users trust in the cloud service provider's capacity to safeguard sensitive personal information from security breaches during transmission and storage	Security concern is an obstacle for adopting cloud-based software	3	Benlian & Hess, 2011
Cost	Expenses for implementing necessary technologies for online transactions as well as those associated with organisational restructuring and business process re-engineering	The amount of money and time invested in training employees to use cloud-based software solutions are very high.	3	Chong & Chan, 2012
Trust	Trust is the confidence that the firm put in the cloud service provider to perform functions that both parties have agreed on as stipulated in the service level agreement.	Cloud-based software vendors are reliable	4	Manuel, 2015
Geographic Dispersion	The extent of which components in a firm are situated across a large number of branches or sites.	Our organisation has various locations	3	O' Leary & Cummings, 2007

Variable	Conceptual Definition	Example Item (Measures)	Number of items	Literature Reference
Top Management Support	Guidance provided by senior management with an organisation to the allocation of resources and the integration of services with the firm	Top management actively encourages employees to use cloud-based software solutions in their daily tasks	3	Chong & Chan, 2012
Cloud Software Readiness	Is considered and used as a crucial variable in predicting diffusion of innovation adoption research	Our firm is dedicated to ensuring that employees are familiar with cloud based software	3	Premkumar & Roberts, 1999
Mimetic Pressures	Pressures arising when organisations try to remain similar to competitors hoping to achieve similar success	It is a strategic necessity to use cloud-based software technology to compete in the market place	3	Liang et al., 2007
Coercive Pressures	Official drives exerted on an organisation by other organisations upon which they are dependent on	When cloud-based software vendors say that their cloud-based software is the best, our organisation believe them	5	Dimaggio & Powell, 1983
Normative Pressures	Pressures arising when an organisation with direct or indirect ties to other organisations that have adopted an innovation can learn about the innovation and its accompanying benefits and costs.	The adoption of cloud-based software is relevant to our organisation	3	Liang et al., 2007

APPENDIX B: Scale Measures

	SCALE MEASURE FOR CLOUD SOFTWARE ADOPTION	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	My company invests resources in (SaaS) cloud based software	1	2	3	4	5
2	Business activities in our company require the use of cloud based software	1	2	3	4	5
3	Applications important to business operations in our firm are running on the cloud	1	2	3	4	5
4	Functional areas in my company require the use of cloud based software	1	2	3	4	5

APPENDIX C: Ethics Clearance



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UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

CLEARANCE CERTIFICATE **PROTOCOL NUMBER: CINFO/1166**

PROJECT: THE ADOPTION OF CLOUD-BASED SOFTWARE AS A SERVICE (SAAS): A DESCRIPTIVE AND EMPIRICAL STUDY OF SOUTH AFRICAN SMES

INVESTIGATOR: Mabuke Maserumule

STUDENT NUMBER: 1436378

SCHOOL: SEBS

DATE CONSIDERED: 31 August 2017

DECISION OF THE ETHICS COMMITTEE: Approved

NOTE

Unless otherwise specified this ethics clearance is valid for 1 year and may be renewed upon application.
Please remember to include the protocol number above to your participation letter.

DATE: 18/09/2017 **CHAIRPERSON:** Jean-Marie Bancilhon

cc: Supervisor:

Prof Jason Cohen

SCHOOL OF ECONOMIC & BUSINESS SCIENCES

APPENDIX D: Final Questionnaire

The purpose of this survey is to conduct a research study on the adoption of cloud-based software as a service (SaaS), across South African small-medium enterprises.

Section 1

Please consider each of the following cloud software solutions and indicate which ones you have adopted, are planning to adopt or have no plans to adopt.

Please select the correct option if you have adopted or not adopted the below mentioned SaaS technologies.

SaaS technology	**We have adopted**	**We have not adopted but we have plans to adopt within the next year**	**We have not adopted and have no immediate plans to adopt**	**We have not adopted but are not sure about plans**	**Don't know if we have adopted or not**
Cloud ERP e.g. NetSuite					
Cloud CRM e.g. Salesforce					
Cloud e-mail e.g. Gmail					
Cloud productivity tools e.g. Microsoft Office 365					
Cloud financial or payroll tools e.g. QuickBooks Online					
Cloud e-commerce platform e.g. Shopify					
Cloud storage e.g. Dropbox, Google Drive					
Video conferencing e.g. Webex and Skype					
IT helpdesk/					

ticketing e.g. Zendesk, Jit Bit helpdesk					
Virtual team communication. e.g. Slack, Microsoft Teams and Trello					

If you have adopted any form of SaaS technology, in approximately which year did you first adopt?

The following questions ask about the extent of adoption of cloud-based software in your organisation

Please indicate the extent to which you agree with each of the statements by selecting the option that best reflects your perception

Cloud Software Adoption	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
My company invests resources in (SaaS) cloud based software					
Business activities in our company require the use of cloud based software					
Applications important to business operations in our firm are running on the cloud					
Functional areas in my company require the use of cloud based software					

Please select the best option describing the stage of cloud software adoption within your firm

Cloud Software Adoption	**Not considering** **1**	**Currently evaluating** **2**	**Have evaluated , but do not plan to adopt this technology** **3**	**Have evaluated and plan to adopt cloud based software** **4**	**Have already adopted cloud based software** **5**
At which stage of cloud software adoption is your organisation currently engaged in?					

Section 2

The following statements ask about your perceptions of cloud software. Please indicate to the extent you agree with each statement

1.

Complexity	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
COM1 – The skills required to use cloud-based software is too complex for employees					
COM2 – Integrating cloud-based software in current work practices is very difficult					
COM3 - Integrating cloud-based software with existing IT systems is very complex					
COM4 – The use of cloud based software requires a lot of mental effort					

2.

Relative Advantage	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
RA1 – Cloud based software allows you to manage business operations in an efficient way					
RA2 – The use of cloud based software improves the quality of operations					
RA3 – Using cloud-based software allows the firm to perform specific tasks more quickly					
RA4 - The use of cloud based software offers new opportunities					
RA5 – Using cloud based software allows the firm to increase business productivity					

3.

Compatibility	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
COMP1 – The use of cloud based software fits the work style of our organisation					
COMP2 – The use of cloud based software is fully compatible with our current business operations					
COMP3 – Using cloud based software is compatible with your organisation's corporate culture and value system					
COMP4 – The use of cloud based software will be compatible with existing hardware and software in our organisation					

4.

Security Concern	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
SC1 – In cloud based software, data is safeguarded from unauthorized changes or use					
SC2 – In cloud based software, sensitive data is protected from those who should not have access to it					
SC3 – The security of sensitive information is a major obstacle to your firm using cloud based software					

5.

Cost	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
COS1 – The costs of adopting cloud based software are far greater than the benefits					
COS2 – The cost of maintenance and support of cloud based software is very high					
COS3 – The amount of money and time invested in training employees to use cloud based software is very high					

6.

Trust	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
T1 - Even if not monitored, our firm would trust cloud based software to do the job					

right					
T2 – Our firm trusts cloud based software					
T3 - Cloud based software is dependable					
T4 – Our firm believes that cloud based software providers are trustworthy					

7.

Top Management Support	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
TMS1 – Top management supports the adoption of cloud based software					
TMS2 – Top management allocates adequate resources for adoption of cloud based software					
TMS3 – Top management is aware of the benefits from cloud based software					

8.

Cloud Software Readiness	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
CSR1 – The organisation knows how cloud based software can be used to support operations					
CSR2 – Our firm is dedicated to ensuring that employees are familiar with cloud based software					
CSR3 – Our firm has good knowledge of cloud based software					

9.

Mimetic Pressures	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
MP1 – Many of our competitors are currently adopting cloud based software					
MP2 – Many of our competitors will be adopting cloud based software in the near future					
MP3 – Our main competitors who have adopted cloud based software are favourably perceived by their suppliers and customers					

10.

Coercive Pressures	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
CP1 – Customers that matter to us expect us to use cloud based software					
CP2 – We may not retain our important customers without adopting cloud based software					
CP3 – Customers that are crucial to us encourage us to use cloud based software					
CP4 – Competitive conditions require our firm to use cloud based software					
CP5 – Other firms that dependent on us, require our firm to use cloud based software					

11.

Normative Pressures	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
NP1 – Many of our customers are currently adopting cloud based software					
NP2 – Many of our customers will be adopting cloud based software					
NP3 – The extent of cloud based software adoption by our firm's trading partners is high					

Section 3

The following statements ask about general participation and company data

Your job title: _____

What is your highest level of education? Please tick the appropriate box

☐ Matric

☐ Diploma

☐ Bachelor's Degree

☐ Honours Degree

☐ Master's Degree

☐ Prefer not to say

☐ Other (Please specify)_____

Your number of years spent at the firm: _____

Year of first establishment of your firm: _____

Please tick the appropriate box which best describes your firm's industry

☐ Agriculture ☐ Food Service ☐ Publishing/News

☐ Aerospace ☐ Government ☐ Real Estate

☐ Automotive ☐ Health Care ☐ Transportation

☐ Business services ☐ Hotels ☐ Utilities

☐ Communications ☐ Insurance ☐ Wholesale/Retail

☐Computers ☐Legal ☐Other: _

☐Construction ☐Manufacturing

☐Consumer Products ☐Mining

☐Education ☐Petroleum

☐Finance ☐Pharmaceuticals

Please indicate the approximate number of employees in your firm by ticking the appropriate box

☐<20

☐20-49

☐50-99

☐100-149

☐150-199

☐200-249

☐250+

Geographic Dispersion	**Strongly Disagree** **1**	**Disagree** **2**	**Neutral** **3**	**Agree** **4**	**Strongly Agree** **5**
GD1 –Our organisation has various locations					
GD2 – Our work is limited to a specific location					
GD3 – In our organisation, we have the freedom of choosing a place to perform our work					

Thank you for taking the time to complete this survey.

APPENDIX E: Cover Letter

Dear IT Manager

My name is Mabuke Maserumule. I am completing my Master of Commerce degree in Information Systems at the University of the Witwatersrand, Johannesburg.

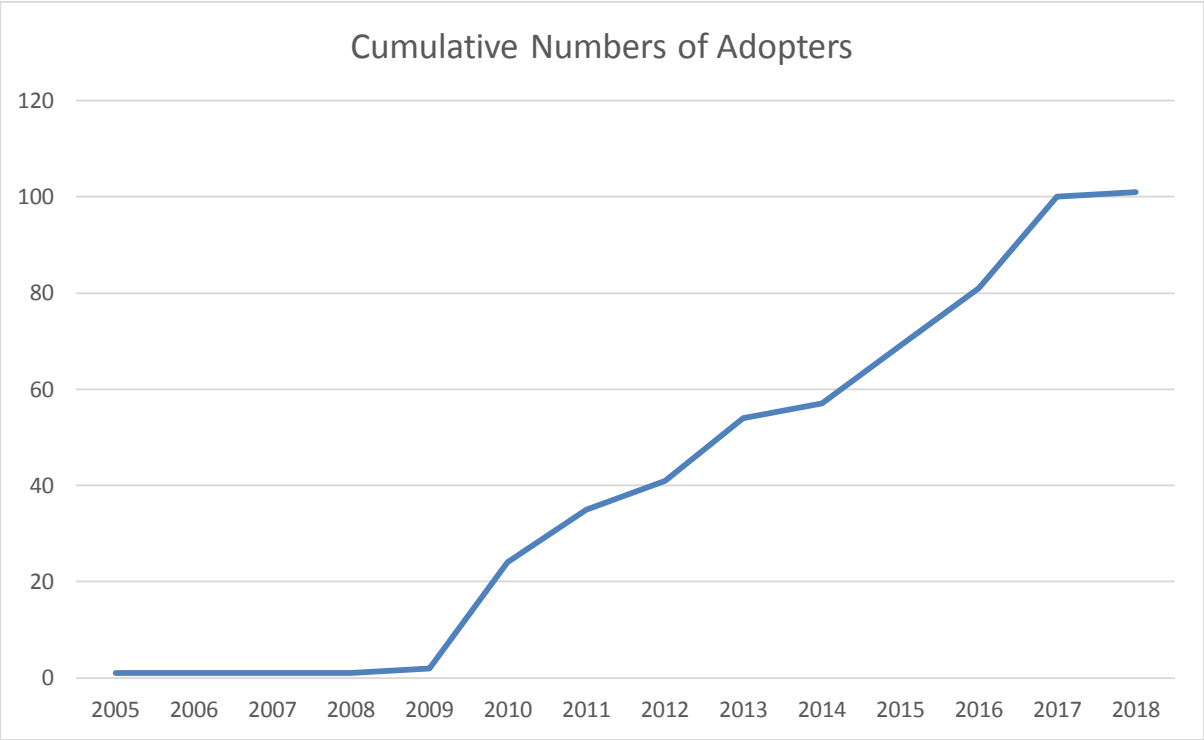
For the purposes of my degree, I am conducting a research study on the adoption of cloud-based software as a service (SaaS), across South African small-medium enterprises. As a business IT manager within your organisation, I am inviting you to complete an online survey with a list of questions relating to whether your organisation has adopted SaaS, and factors associated with adoption. If you agree to participate, the online survey will take approximately 15 minutes to complete. The questionnaire is divided into two sections. Section 1 consists of 10 questions about complexity, relative advantage, compatibility, security concern, cost and, trust. Section 2 consists of 10 questions related to geographic dispersion, top management support, skills of IT resources, mimetic pressures, coercive pressures and normative pressures. Responses are provided on a 5-point scale from strongly disagree to strongly agree. There are a number of questions about the organisation e.g. size, industry, and about the respondent e.g. job role, number of years at the organisation.

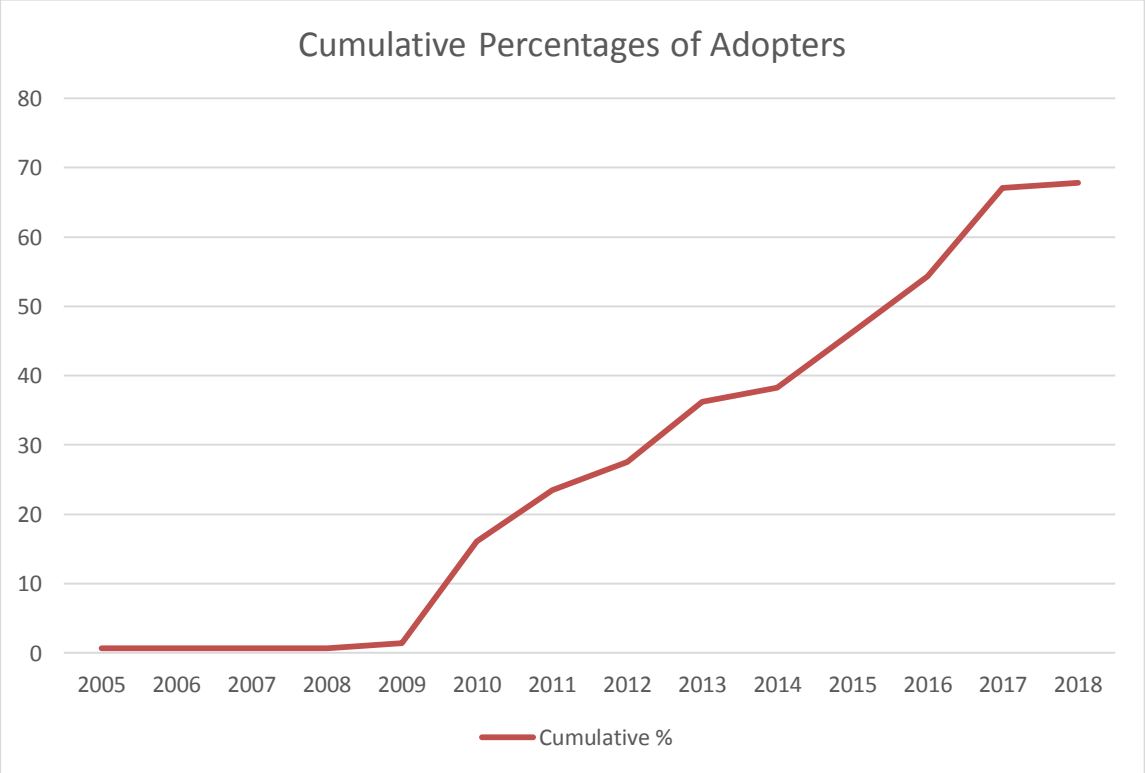
Please note that your participation is voluntary and involves no risk, penalty, or loss of benefits whether or not you participate. You may withdraw from the survey at any stage. This questionnaire is for research purposes only. There are no right or wrong answers. All responses will be kept strictly confidential. All responses are anonymous because you are not asked to provide your name nor that of your organisation. Results will only be reported in the aggregate and a copy of the report will be made available to respondents on request. All data will be destroyed once the University requirements have been met. To access the questionnaire, please follow this link: https://www.esurveycreator.com/s/6005fab

Thank you for considering participating. Should you have any questions, or should you wish to obtain a copy of the results of the survey, please contact me on (076) 573-3256 or at 1436378@students.wits.ac.za. or you may contact my supervisor Professor Jason Cohen on (011)717 -78164 or at Jason.cohen@wits.ac.za
Kind regards

Mabuke Dorcus Maserumule
MCom Student
School of Economic and Business Sciences
University of the Witwatersrand, Johannesburg

APPENDIX F: Diffusion Curve Data





APPENDIX G: Principal Components Analysis for Technological Factors

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.931
Bartlett's Test of Sphericity	Approx. Chi-Square	2771.008
	df	171
	Sig.	.000

The KMO was close to 1 and Bartlett's test was significant. Therefore, PCA was appropriate with total percentage of variance 88.095%

Rotated Component Matrix[a]						
	Component					
	1	2	3	4	5	6
Complexity1		**.763**				
Complexity2		**.830**				
Complexity3		**.775**				
Complexity4		**.805**				
RelatAdvantage1	**.753**					
RelatAdvantage2	**.777**					
RelatAdvantage3	**.830**					
RelatAdvantage4	**.767**					
RelatAdvantage5	**.795**					
Compatibility1			**.657**			
Compatibility2			**.760**			
Compatibility3			**.738**			
Compatibility4			**.686**			
SecurConcern1				**.859**		
SecurConcern2				**.807**		
Cost1						**.908**
Cost2						**.615**
Trust1					**.832**	
Trust2					**.619**	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 7 iterations.						

APPENDIX H: Principal Components Analysis for Environmental Factors

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.872
Bartlett's Test of Sphericity	Approx. Chi-Square	878.233
	df	36
	Sig.	.000

The KMO was close to 1 and Bartlett's test was significant. Therefore, PCA was appropriate with total percentage of variance 81.805%

Rotated Component Matrix[a]			
	Component		
	1	2	3
CoerPress1	**.862**		
CoerPress2	**.743**		
CoerPress4	**.723**		
CoerPress5	**.817**		
MimePress2			**.831**
MimePress3			**.840**
NormPress1		**.752**	
NormPress2		**.781**	
NormPress3		**.831**	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

APPENDIX I: Principal Components Analysis for Organisational Factors

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.855
Bartlett's Test of Sphericity	Approx. Chi-Square	684.383
	df	15
	Sig.	.000

The KMO was close to 1 and Bartlett's test was significant. Therefore, PCA was appropriate with total percentage of variance 92.858%

Rotated Component Matrix[a]			
	Component		
	1	2	3
GeoDisp1			**.996**
TopManSupport1	**.777**		
TopManSupport2	**.896**		
TopManSupport3	**.840**		
CloudSoftReadines1		**.859**	
CloudSoftReadines3		**.861**	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

APPENDIX J: Principal Components Analysis for Cloud Adoption

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.806
Bartlett's Test of Sphericity	Approx. Chi-Square	479.729
	df	6
	Sig.	.000

The KMO was close to 1 and Bartlett's test was significant. Therefore, PCA was appropriate with total percentage of variance 82.890%

Component Matrix[a]	
	Component
	1
CloudSoftAdop1	.846
CloudSoftAdop2	.911
CloudSoftAdop3	.939
CloudSoftAdop4	.943
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

APPENDIX K: Reliability Descriptive Statistics

Construct	Number of Items	Cronbach's Alpha	Mean	Std. Deviation	Skewness	Kurtosis
Geodisp1	1	N/A	3.56	1.474	-.619	-1.136
Composite Cloud Readiness Software	2	0.922	3.2105	1.19241	-.326	-1.061
Composite Top Management Support	3	0.943	3.3058	1.16410	-.471	-.775
Composite Normative	2	0.891	3.2264	1.05140	-.407	-.623
Composite Coercive	4	0.890	2.9142	1.01266	-.039	-.819
Composite Mimetic	2	0.873	3.3507	1.12228	-.401	-.790
Composite Cost	2	0.764	2.7519	1.07889	.485	-.735
Composite Trust	2	0.869	3.1692	1.11401	-.348	-.898
Composite Relative Advantage	5	0.970	3.7263	1.16373	-.874	-.323
Composite Security Concern	2	0.906	3.2744	1.20691	-.489	-.747
CompositeComplexity	4	0.918	2.7369	1.19220	.494	-.751
CompositeCompatibility	4	0.955	3.4361	1.12459	-.541	-.806
CompositeAdoption	4	0.931	3.1026	1.27410	-.063	-1.258

APPENDIX L: Correlations of Variables

Correlation with Composite Adoption	
CompositeCompatibility	.721**
Composite Complexity	-.503**
Composite Relative Advantage	.666**
Composite Security Concern	.652**
Composite Cost	-.430**
Composite Trust	.638**
Geographic Dispersion (Geodisp1)	.082
Composite Cloud software readiness	.685**
Composite Top Management Support	.703**
Composite Coercive	.642**
Composite Normative	.602**
Composite Mimetic	.462**p

APPENDIX M: Stepwise Regression Analysis for Variables

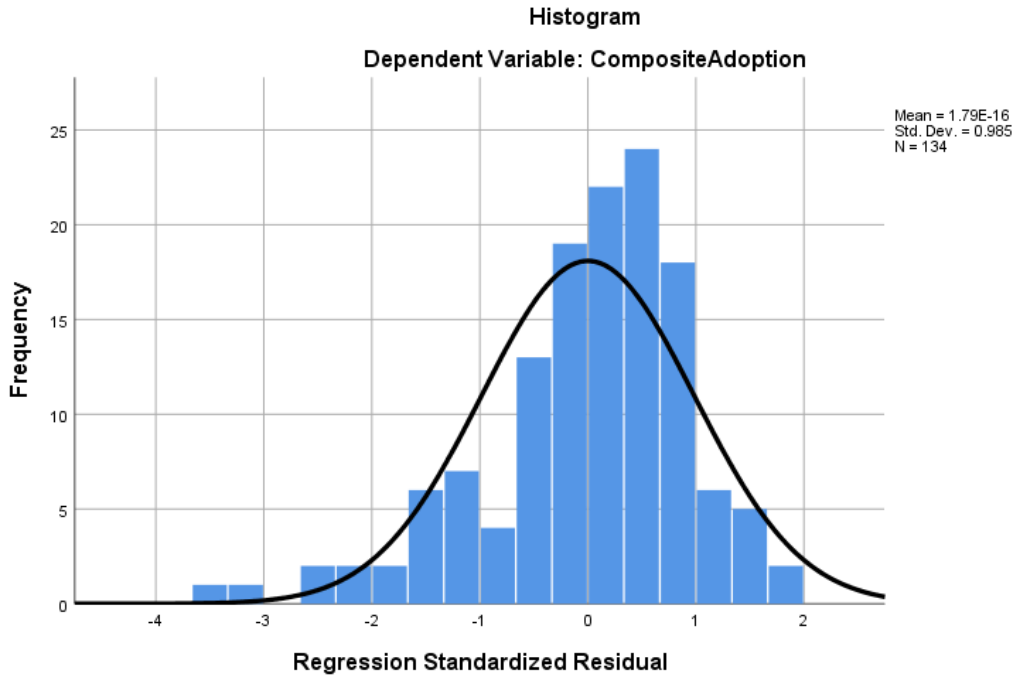
Coefficients[a]

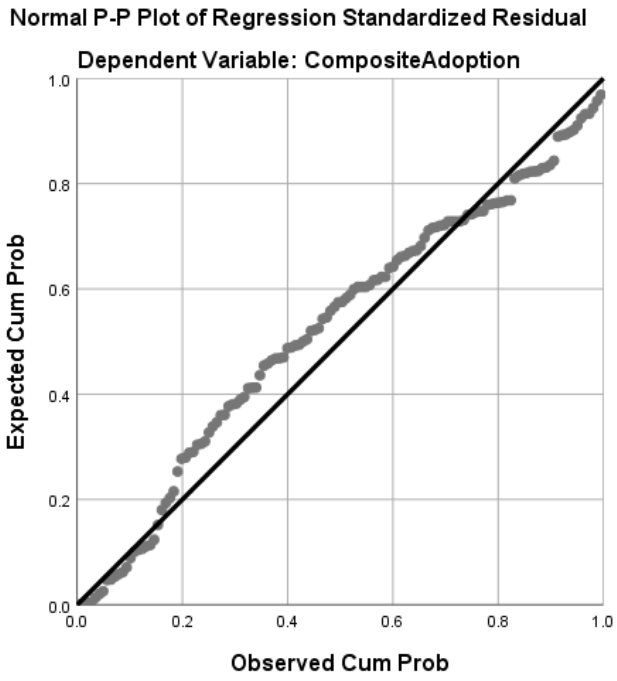
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.294	.247		1.191	.236
	CompositeCompatibility	.817	.068	.721	11.971	.000
2	(Constant)	-.015	.238		-.065	.948
	CompositeCompatibility	.506	.091	.447	5.540	.000
	CompositeTopmanSupport	.417	.088	.381	4.720	.000
3	(Constant)	-.177	.236		-.749	.455
	CompositeCompatibility	.417	.093	.368	4.491	.000
	CompositeTopmanSupport	.311	.092	.284	3.396	.001
	CompositeSecurityConcern	.250	.079	.237	3.174	.002
4	(Constant)	-.284	.240		-1.187	.237
	CompositeCompatibility	.336	.100	.297	3.346	.001
	CompositeTopmanSupport	.222	.101	.203	2.196	.030
	CompositeSecurityConcern	.271	.079	.256	3.444	.001
	CompositeCoercive	.210	.106	.167	1.983	.050

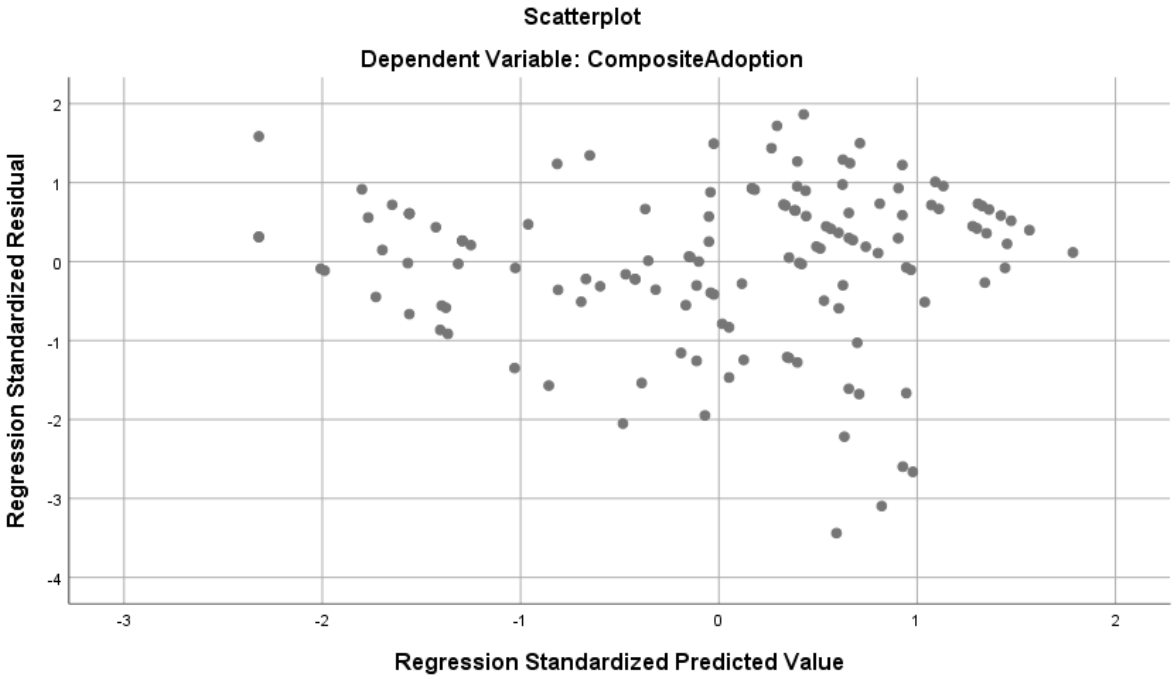
a. Dependent Variable: CompositeAdoption

Coefficients[a]							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.294	.247		1.191	.236		
CompositeCompatibility	.817	.068	.721	11.971	.000	1.000	1.000
(Constant)	-.015	.238		-.065	.948		
CompositeCompatibility	.506	.091	.447	5.540	.000	.481	2.081
CompositeTopmanSupport	.417	.088	.381	4.720	.000	.481	2.081
(Constant)	-.177	.236		-.749	.455		
CompositeCompatibility	.417	.093	.368	4.491	.000	.436	2.293
CompositeTopmanSupport	.311	.092	.284	3.396	.001	.417	2.397
CompositeSecurityConcern	.250	.079	.237	3.174	.002	.526	1.902
(Constant)	-.284	.240		-1.187	.237		
CompositeCompatibility	.336	.100	.297	3.346	.001	.364	2.746
CompositeTopmanSupport	.222	.101	.203	2.196	.030	.335	2.986
CompositeSecurityConcern	.271	.079	.256	3.444	.001	.517	1.936
CompositeCoercive	.210	.106	.167	1.983	.050	.403	2.481

a. Dependent Variable: CompositeAdoption







- VIF values are below 5
- Plot of residuals is close to the line and fairly normal as per histogram
- Plot to test heteroscedasticity shows no obvious pattern.

APPENDIX N: Summary of Results

Variable	Correlation	Multiple Regression	Stepwise Regression
Technological			
H1:Complexity	**Supported**	Not Supported	Not Supported
H2: Relative Advantage	**Supported**	Not Supported	Not Supported
H3:Compatibility	**Supported**	**Supported**	**Supported**
H4:Security Concern	**Supported**	**Supported**	**Supported**
H5:Cost	**Supported**	Not Supported	Not Supported
H6:Trust	**Supported**	Not Supported	Not Supported
Organisational			
H7:Geographic Dispersion	Not Supported	Not Supported	Not Supported
H8:Top Management Support	**Supported**	**Supported**	**Supported**
H9:Cloud Software Readiness	**Supported**	**Supported**	Not Supported
Environmental			
H10:Mimetic Pressures	**Supported**	Not Supported	Not Supported
H11:Coercive Pressures	**Supported**	**Supported**	**Supported**
H12: Normative Pressures	**Supported**	**Supported**	Not Supported