Cloud Computing Benefit Realisation in a South African Public Sector: A post-adoption study

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Abstract

Background: Cloud Computing is a globally evolving trend that is changing the landscape of Information Technology as we know it. The perceived benefits of Cloud adoption are spurring IT leaders to move to Cloud Computing to maintain the competitive edge, regardless of some of the challenges associated with Cloud adoption. Currently, the predominant reason for organisations to adopt Cloud Computing is the reduction of costs. However, some organisations report that they are not receiving the perceived benefits as expected pre-adoption. Despite this known fact that cost reduction is not guaranteed, organisations are expected to increase their IT spending in the future on Cloud Computing. As organisations are reporting that they are not receiving a tangible and easily measurable benefit such as cost reduction, it is imperative for organisations to measure and confirm that intangible benefits which are difficult to quantify are being received. This measured approach is essential to aid organisations in understanding the actualised benefits of Cloud Computing.

Objective: Current literature predominantly focuses on the adoption of Cloud Computing with the private sector as its consumers. Minimal research has been explored with Cloud Computing post-adoption, explicitly focusing on the South African public sector context. Little is known about these organisations and if they have actualised the perceived benefits from its adoption phase. Further to this, understand how these organisations have measured the degree in which they have benefited from the adoption. The purpose of this research is to contribute to knowledge regarding organisations in the public sector and what factors influence the actualisation of perceived adoption benefits post-implementation.

Method: The researcher adopted a constructivism ontological stance, interpretivist epistemology, and an inductive approach to conduct this research. Qualitative data was collected in the form of 20 semi-structured interviews conducted over a period of 12 months. These interviews were conducted in an organisation in the public sector that has implemented Cloud solutions already, and can provide a retrospective view of its adoption. Thematic analysis was utilised to sort the responses into categories and themes. These themes were further filtered by using a research model based on the TOE framework as the lens to structure the data.

Findings: This research revealed a discrepancy in the perceived benefits of pre-adoption and the received actualised benefits of post-adoption across the organisation. This is primarily due to the lack of IT management predefining metrics to determine the degree that the adoption has benefited the organisation. Secondly, depending on the type of Cloud service and user role, benefits can vary, thus having one part of the organisation very satisfied and another area dissatisfied. Lastly, the pre-adoption factor for adoption is not necessarily a factor that influences the continued use of Cloud Computing. External factors such as the COVID-19 pandemic have shifted perceptions and organisational requirements due to the increased pressure to deliver services and work remotely. This increase in dependency on Cloud Computing altered the main factor of cost reduction, so significantly that if the Cloud would cost more, the organisation would continue its use due to the additional benefits that Cloud Computing provides.

Keywords: Cloud Computing, post-adoption, benefit actualisation, implementation, public sector, government.

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Abbreviations and Acronyms

ARPANET	Advanced Research Projects Agency Network
AWS	Amazon Web Services
BaaS	Business as a Service
CERN	European Council for Nuclear Research
CEO	Chief Executive Officer
CFO	Chief Finance Officer
CIO	Chief Information Officer
CRM	Customer Relationship Management
DaaS	Desktop as a Service
EC2	Amazon Elastic Compute Cloud
EDI	Electronic Data Interchange
ENIAC	Electronic Numerical Integrator and Computer
FaaS	Framework as a Service
FTP	File Transfer Protocol
G2B	Government to Business
G2C	Government to Citizen
G2G	Government to Government
HaaS	Hardware as a Service
IaaS	Infrastructure as a Service
IBM	International Business Machines
ICT	Information Communication Technology
IOS	Inter-Organisational Systems
IT	Information Technology
NIST	National Institute of Standards and Technology
OaaS	Organisation as a Service
OGE	Office of Government Ethics
PaaS	Platform as a Service
PC	Personal Computer
POPI	Protection of Personal Information
SaaS	Software as a Service
SARS	South African Revenue Service
SITA	State Information Technology Agency
SLA	Service Level Agreement
TAM	Technology Adoption Model
TENET	Tertiary Education and Research Network
TOE	Technology-Organisation-Environment
UCT	University of Cape Town
USA	United States of America

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1. Introduction

1.1 Background and Problem Description

The current view of Cloud Computing is that it is transitioning and evolving from being seen as a market-disrupting technology to becoming the norm and next-generation technology (Smith, 2020). Cloud Computing adoption success stories have caused significant investment growth from vendors and end-users alike. Organisations are identifying areas where Cloud Computing can be utilised to ensure that their business has a competitive advantage in their relevant business sector (Malik, Wani & Rashid, 2018). Cloud Computing adoption is further spurred on by the fact that IT (Information Technology) top management in South Africa are starting to transition towards an operating expenditure model from a capital expenditure model. This transition has also aided in the steady increase of outsourcing services by adopting Cloud Computing (Johnston, Loot & Esterhuyse, 2016).

This outsourcing can be seen in the public sector as government CEOs (Chief Executive Officer) who are implementing an enterprise IT strategy that looks at Cloud-first for its initiatives. This change is primarily due to vendors claiming that the Cloud is a means to improve service delivery, remove legacy systems, and lower costs. These claims made to the government are very appealing as they are known for having periods of severe fiscal constraint while still having to provide the same service to its citizens (Cannon & Archer, 2016). Although the potential financial benefit is the primary driver of adoption, many government organisations fail to plan for any other potential benefit realisation. This short-sighted planning can lead to organisations missing out on opportunities and other benefits such as agility to create a more responsive government. This benefit would be vital to the government given current unrest regarding poor service delivery or the lack thereof (Cannon, 2015; Ngcamu, 2019).

Some CIOs (Chief Information Officer) have not implemented a strategic plan for their enterprises, which can negatively affect the future of their Cloud adoption. This lack of directive can lead to ad-hoc adoptions by so-called shadow IT personnel and, in some cases, cause a cost increase with the lift and shift approach. Some organisations have seen the implementation of one or two Cloud services, such as mail or a website, as sufficient progress to end their Cloud journey (Cannon, 2020). This lack of directive highlights some fundamental and practical issues of Cloud adoption in these organisations. The Cloud-first policy inadvertently becomes a measurement of how quickly the organisation adopts Cloud, and not how comprehensive, and well the initiative is adopted (Cannon & Archer, 2016).

As seen in Figure 1, a review of Cloud adoptions globally has shown that 68% out of 831 private organisation respondents have successfully implemented Cloud, with government organisations a little further behind with 63% out of 91 respondents having a successful implementation. However, the most significant difference is the failure percentage after full deployment, with 24% of government organisations failing compared to only 9% in private organisations (Cannon & Brown, 2021).

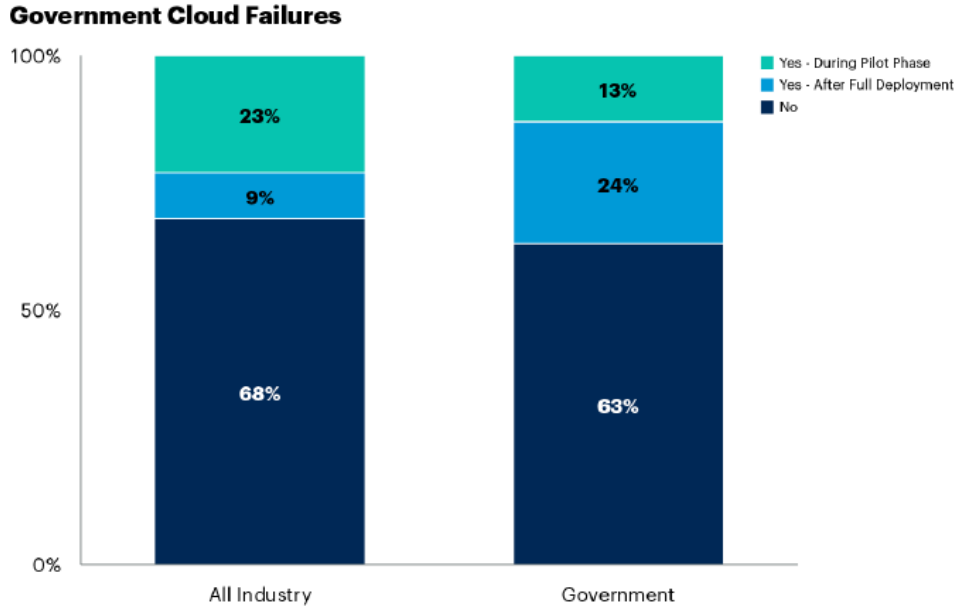

Figure 1 Cloud adoption Failures (Cannon, 2021)

These failures in government adoption are theorised to be attributed to many factors and theories. Firstly, the factors of benefits realisation were not informed by all levels in the organisation (Cannon, 2015). Secondly, poor governance and increased bureaucracy can cause delays in making decisions (Cannon, 2021). Lastly, acting on recommendations by vendors based on hearsay and marketing hype (Cannon & Archer, 2016). However, these theories do not depict if the organisations received some or all of the perceived benefits as anticipated, to what level they have received it, and the main reason or to what degree the implementation was not deemed successful.

Currently, research is limited relating to post-adoption benefits of Cloud Computing in the context of a South African public organisation. The public sector has indicated that the adoption of ICT's is vital to the development of the country. This has spurred on the recent publication of its Cloud/ICT policies regarding Cloud utilization, of which it has taken a cloud first approach (Microsoft, 2020; DCDT, 2021). Given that this push to adopt Cloud is based on its perceived benefits, it is critical to understand if the organisation is actualising Cloud benefits post-adoption. This research aims to provide a contribution to knowledge by furthering the understanding and theory of Cloud Computing, focusing on the benefits actualised from the usage of Cloud Computing post-adoption. In addition, to understand how organisations measure the benefit to deem it successful or actualised.

The research is divided into five main sections. Section 1 is the Introduction; this introduces the topic of Cloud Computing and explains what the research covers and the problem the researcher is addressing. Section 2 is the Literature Review; this is a comprehensive review of available literature pertaining to Cloud Computing theories and research models used to determine relevant factors. Section 3 is the Research and Design, which reviews the researcher's assumptions, motivations of research components, and strategies chosen to conduct this study. Section 4 is the Findings and Analysis; this section presents themes identified through thematic analysis, categorised under the research model by Hassan et al., 2017. Section 5 is the Discussion; these findings are further discussed to encapsulate the outcomes as they relate to the research question. Section 6 is the Conclusion; this is the final section and provides an overall research summary.

1.2 Problem Statement

Many organisations are driven to adopt technologies such as Cloud Computing due to the anticipated perceived benefits that they would receive (Malik, Wani & Rashid, 2018). However, some IT leaders have not actualised these advertised benefits post-adoption, and in some cases, it has had the opposite effect of the desired outcome (Cannon & Brown, 2021). Furthermore, they have not been able to put measures in place to evaluate all possible Cloud Computing benefits that are both tangible and intangible, making it difficult to understand to what degree the benefit was achieved or failed (Johnston, Loot & Esterhuyse, 2016). There is an urgent need for the researcher to understand this phenomenon as there is insufficient literature pertaining to Cloud Computing post-adoption. Given the rapid rate of adoption currently seen across the globe, it is imperative for organisations to understand the realistic benefit of Cloud post-adoption prior to heavily investing in specific technologies.

1.3 Research Objectives

There has been a global interest and rapid uptake in adoption of Cloud Computing. The South African Public Sector has indicated that ICTs are a critical component in developing the country. The main objectives of this research are:

- Understand how Cloud Computing has benefited the South African public sector after its adoption.
- Have the perceived benefits of the organisation been actualized
- Understand what the organisation used to measure the success of the adoption.

1.4 Research Questions

These objectives were accomplished by answering the following main research question:

(MRQ1)	What factors influence South African public organisations to actualised perceived per-adoption Cloud Computing benefits?

This question was further divided into the following sub-questions:

(SQ1)	To what extent are perceived Cloud Computing pre-adoption benefits actualised in technology post-adoption?
(SQ2)	To what extent are perceived Cloud Computing pre-adoption benefits actualised in the organisation post-adoption?
(SQ3)	To what extent are perceived Cloud Computing pre-adoption benefits actualised in the environment post-adoption?
(SQ4)	How are actualised Cloud Computing benefits measured by South African public organisations to deem it successful?

A research framework was identified within the literature review and utilised to address these questions.

1.5 Research Motivation

Cloud Computing describes many benefits and challenges when adopting or moving workloads onto its platforms, such as cost reductions, flexibility, scalability, increased productivity, better performance, reliability, and security. A survey done by Gartner measured the perceived benefits of Cloud adoption by IT leaders. As seen in Figure 2, 34% of respondents stipulates cost-savings as their primary reason for adoption, with another 19% as their second reason, followed by another 10 % indicating it as their third reason. A primary motivation of adoption for 63% of companies is cost-saving first, followed somewhat evenly by other benefits such as agility and innovation (Smith, 2020).

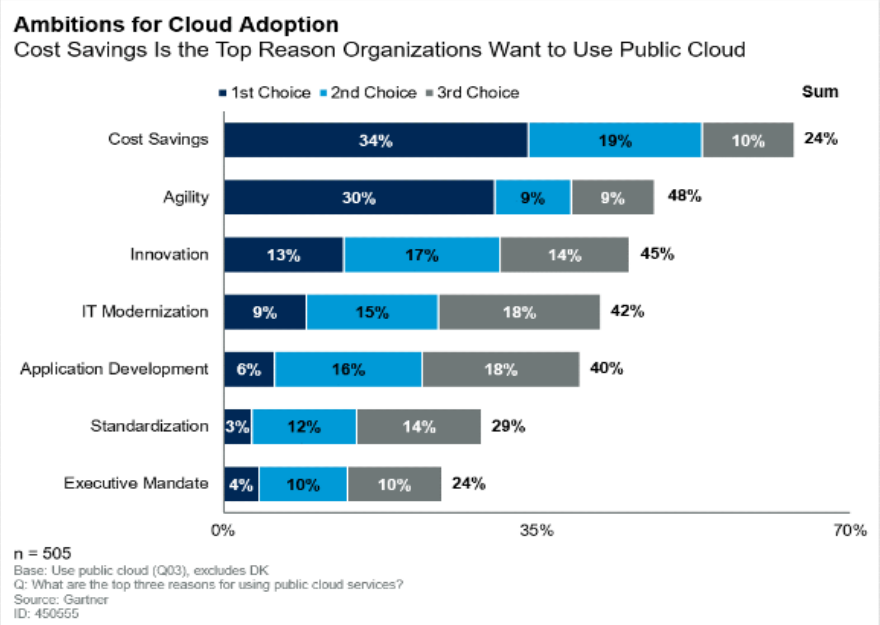

Figure 2: Ambitions for Cloud Computing (Smith, 2020)

Post-adoption however, organisations have not actualised some of the perceived benefits, which were the primary drivers for its initial adoption. As seen in Figure 3, only 36 % of organisations that have adopted Cloud Computing have reported that their spending on IT post-implementation has decreased. These statistics are in significant opposition to the remaining organisations, of which 36% of organisations have reported no cost savings post-implementation, and a further 28% have reported an increase in cost (Smith, 2020).

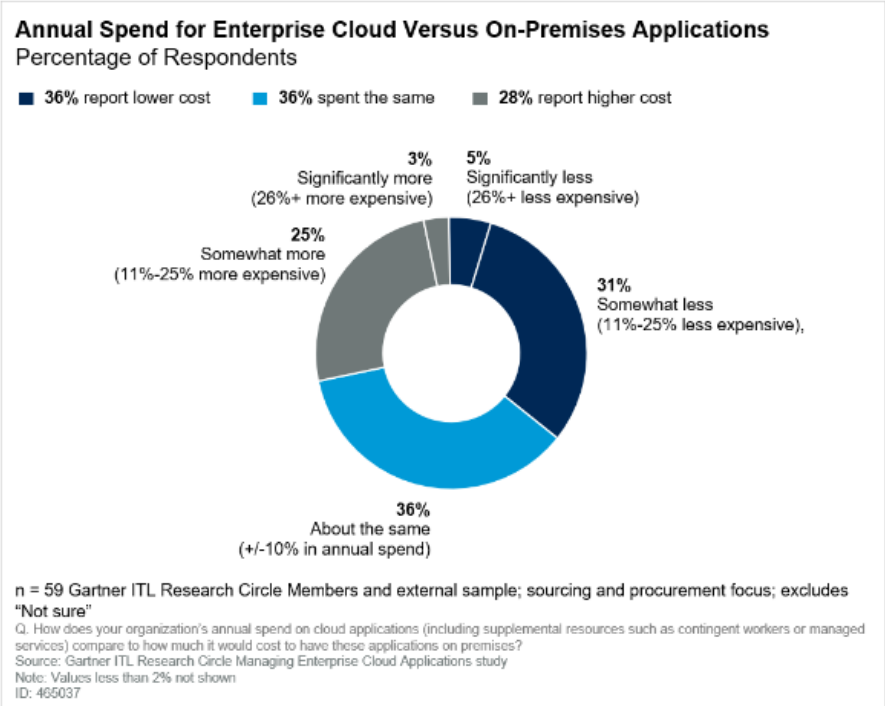

Figure 3: Annual Spend for Enterprise Cloud Versus On-Premises Applications (Smith, 2020)

Cost-saving is one of the less complicated benefits to measure in comparison to others that are subjective or intangible. If the organisation is not receiving the cost-saving benefit, the assumption can be made that other benefits could also not be received. Identifying and evaluating these benefits for IT leaders has become a difficult task as they cannot determine the actualised benefits of Cloud adoption (Moyle, 2017). Research conducted in the field of IT valuation has increased because IT leaders are questioning the value of IT and their investment. Although the amount of research is substantial on the topic of IT valuation, there is still no alignment and consistency in opinions, findings, terminology, and methods. (Johnston et al., 2016).

It is essential that existing literature is utilised to assess claims that are made with regard to the impact of the Cloud on an enterprise. These claims should be assessed against empirical evidence collected from the field. A finding from 30 interviews with experienced Cloud vendors and users between 2010 and 2012 highlighted that most organisations could not evaluate Cloud benefits; have a poor understanding of their IT expenditure; and are unable to quantify risks associated with Cloud (Chihande & van der Poll, 2017).

Most literature found on Cloud Computing focuses on the perceived benefits and challenges of pre-adoption. The claims of perceived benefits have no standardised tool for measurement, making it difficult to establish if an organisation has realised the expected value. Not much literature has been found that focuses on post-adoption realised benefits and challenges, and even less that focuses primarily within the South African context. Further research in this area of measuring the realised benefits and challenges of Cloud Computing adoption is required.

1.6 Relevance and Gaps

Cloud Computing utilisation is currently one of the most pertinent and spoken-of technologies in organisations. Its use in the Public Sector and specifically in the context of South Africa is relevant for multiple reasons. Firstly, the various public sector agencies are under scrutiny due to their inadequate service delivery to their citizens (Ngcamu, 2019). Secondly, current studies on Cloud Computing mainly focus on the advantages and disadvantages for the purpose of technology adoption and implementation. These studies do not provide any empirical results in their literature regarding post-implementation despite the growing interest in issues of Cloud Computing (Caldarelli, Ferri & Maffei, 2017).

The focus of these studies was on Cloud Computing adoption and how it relates to economic benefits and convenient ease of use in delivering its computing services. These studies also predominantly focus on the private sector, and few focus on the South African context. As seen in Table 1, these studies have both qualitative and quantitative methods that have been utilised to conduct research in the Public Sector. The findings of these studies highlight key enablers in accelerating the adoption of Cloud Computing, enticing the prospective adopters that it will result in cost reduction and providing them with a competitive edge. These studies, however, do not refer to post-adoption utilisation, confirmation of measured success, and actualised benefits.

Title	Year	Authors	Analysis	Framework	Overview
Modernizing the Public Sector through the Cloud	2016	Microsoft	Qualitative	N/A	This is paper focuses on pre-adoption stage. It analyses the readiness and how to prepare for the adoption of ICT's and Cloud Computing in the public sector
Understanding Cloud Adoption Decisions in the Public Sector	2015	Polyviou, A & Pouloudi, N	Qualitative	Technology, Organisation and Enviroment (TOE)	This is paper focuses on pre-adoption stage. It analyses the percieved benefits and challenges of Cloud Computing in the public sector
Technical and Environmental Factors Affecting Cloud Computing Adoption in the South African Public Sector	2016	Scholtz, B., Govender, J., & Gomez, J	Quantitative	Technical and Environmental Framework	This is paper focuses on pre-adoption stage. It analyses the challenges of Cloud Computing in the public sector
Adoption of Cloud Computing by the South African public sector	2016	Govender, J	Quantitative	Technology, Organisation and Enviroment (TOE)	This is paper focuses on pre-adoption stage. It analyses the challenges of Cloud Computing in the public sector

Exploring the impact of Cloud Computing on existing South African regulatory frameworks	2020	Mohlameane, M & Ruxwana, N	Mixed-Method	Thematic Analysis	This is paper focuses on pre-adoption stage. It analyses the regulatory frameworks as a challenges to adopt Cloud Computing in the public sector
The readiness of the South African private and public sector for the fourth industrial revolution	2018	Putzier, M	Mixed-Method	Conceptual research framework	This is paper focuses on pre-adoption stage for readiness. It analyses how the public sector will adopt and change into the future to be ready for the Four Industrial Revolution

Table 1: Research Methods

Thirdly, some benefits of Cloud Computing are not as easy to determine as it is to compute cost-saving, as some of these benefits can be subjective, tangible, or intangible. Evaluating these benefits for IT leaders has become a difficult task as they are unable to determine the actual benefits of Cloud adoption (Moyle, 2017).

Lastly, adoption models currently do not explain the current phenomena experienced. Currently, the literature indicates that the adopter is not receiving the perceived benefit, yet there is the continued use of the innovation and, in some cases, further expansion of its use (Smith, 2020). However, adopter intent and models indicated that if an adopter receives the perceived benefit, the innovation will be continued to be utilised; if not, the innovation will be abandoned (Frambach & Schillewaert, 2002).

This research aims to provide a contribution to the knowledge of Cloud Computing post-adoption, focusing on actualised benefits in South African Public Sector organisations. The research further aims to understand what the organisation's adopters have experienced to be its benefits and what they have utilised to measure both tangible and intangible benefits.

2. Literature Review

A systematic review is an essential first step in research as it reveals to the researcher what is already known regarding a specific topic in the existing literature. The researcher gathers empirical information comprised of the best evidence research and organisational thought process. Afterward, this information is processed, synthesised, and brought together to answer a specific research question (Paré, Trudel, Jaana & Kitsiou, 2015).

In this chapter, empirical information has been gathered on Cloud Computing and synthesised into 8 sections. In section 1 Cloud Computing is defined as an technology and provides a working definition; Section 2 provides a timeline of how Cloud Computing has developed from its initial concept to what it is known as today; Section 3 provides an in-depth view of the different methods used to deliver Cloud Computing to organisations; Sections 4 lists the benefits and motivating factors of adopting Cloud solutions; Section 5 in contrast lists the challenges organisations might face when adopting Cloud solutions' Section 6,places Cloud Computing in a South African context and highlights factors which are unique to the public sector; Section 7 provides insight into the driving factor of why organisation adopt innovations and lastly; Section 8 provides

2.1 Defining Cloud Computing

Currently, there is no singular accepted definition of Cloud Computing utilised by all organisations. There are disparities in what the term "Cloud" means due to its misuse by organisations when referring to different services. Some examples of these definitions are listed below:

- Microsoft (2020, para. 1) defines Cloud Computing as the "delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet ("the Cloud") to offer faster innovation, flexible resources, and economies of scale. You typically pay only for Cloud services you use, helping you lower your operating costs, run your infrastructure more efficiently, and scale as your business needs change".
- Islam & Grégoire (2012, p.1) defined Cloud Computing as "a collection of applications, hardware and system software which are designed to deliver services to end-users over the internet" (Olumide, 2018).
- Mell & Grance (2011, p.2) from The National Institute of Standards and Technology (NIST) has defined Cloud Computing as "a model that enables 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 service provider interaction."

The NIST definition is widely recognised and broadly used by many authors as their working definition (Mell & Grance, 2011; Rajaraman, 2014 ; Hassan et al, 2017). This definition is primarily used due to the fact that other definitions of Cloud Computing are found not to be neutral, instead highlighting and focusing on specific aspects of Cloud Computing characteristics (Olumide, 2014). In addition to these five characteristics mentioned in the NIST definition of Cloud Computing, the Cloud service and deployment models appear to be standardised. Cloud Computing has three primary service models (PaaS, IaaS, SaaS) and four models for deployment (Public Clouds. Private Cloud, Hybrid-Cloud, and

Community Cloud) (AWS, 2020). These architecture artifacts are further expanded on in the below section.

2.2 History of Cloud Computing

Analysing trends of the ’60s and ’70s, Cloud Computing is found to have its roots derived from some old ideas such as distributed computing, grid computing, time-sharing, and virtualisation. The Cloud Computing phenomena can be seen as a re-invention of these trends, which are leveraged from centralised and shared computing resources but with new business and technical perspectives (Böhm, Leimeister, Riedl & Krcmar, 2011).

There is some disagreement about who first coined the term Cloud Computing. Bairagi and Bang (2015) credit the telephone industry, Pal (2016) associate credit to Professor Ramnath Chellappa of the University of Texas, who presented a talk on a new computing paradigm in 1997, and Arutyunov (2012) credits George Favaloro and Sean O’Sullivan from Compaq Computers who drafted a Cloud Computing strategy in 1996 at one of the thematic internet conferences in 2008.

According to a paper by Böhm, Leimeister, Riedl, Krcmar (2011), the development of the modern computer began in 1941 with the construction of the Z3. This computer was based on a binary digit system and signified the first digital computer. A few years later, in 1945, the Electronic Numerical Integrator and Computer (ENIAC) was constructed by John Mauchley and J. Presper Eckert. This computer was based on the decimal system. Either of these two computers can be considered the first computer, depending on the definition used to define what a computer is. Development and advancement of the computer increased from 1947 with the invention of the transistor. The introduction of the 704 mainframe computer by IBM in 1957 was the first computer mass produced of its kind. The processing and operations of these computers were expensive; thus, operators employed methods to utilise them differently to try and offset costs. These devices were known as “the most powerful electronic brain” during this period (IBM, 2020, para. 4). Thus, the concept of time-sharing was established by companies, which permitted external users to utilise idle CPU time, which was distributed across several users. This concept was the foundation to what eventually would lead to the creation of independent service providers of computing resources (Böhm et al., 2011).

There is some agreement that in 1960, John McCarthy from MIT introduced the concept of Cloud Computing. McCarthy wrote a note to the Director of the Computer Centre requesting that the teletypewriters in his faculty offices, be permitted to connect to the computer for time-shared use by several persons (Bairagi & Bang, 2015; Rajaraman, 2014). McCarthy also stated, “If the computers of the kind I have advocated become computers of the future, then computers someday will be organised as a public utility just as a telephone system is a public utility. The computer utility could become the basis of a new and important industry” (Rajaraman, 2014, p. 244). IBM in 1964 recognised that utility computing could provide a significant income stream. This success brought on the release of the IBM System/360. IBM also acted as a service provider during this time and provided businesses access to their servers at a high cost (Mokhtar, Ali, Alsharafi & Aborujilah, 2013).

In 1966, Douglas Parkhill, in his book called The challenge of the Computer Utility, explored the characteristics of Cloud Computing for the first time (Bairagi & Bang, 2015). One of the most critical

years for Cloud Computing was 1969; during this year, the first microprocessor known as the 4004 was created, which was a major contributing factor in building the personal computer (PC) (Böhm et al., 2011). Secondly, a project by J.C.R. Licklider was also underway the same year which envisioned interconnecting everyone's data and programs from any site. This project developed what became known as ARPANET (Advanced Research Projects Agency Network), which later became the foundation for the internet (Pal, 2016).

In 1975 one of the first home computers called the Altair 8800 was constructed by MIT. This device had a basic Interpreter, which Microsoft developed. Further developments were made, and more home computers from companies such as Apple and Atari were released. In 1981, the term Personal Computing was coined by IBM when they entered the market with the IBM-PC, which had a Microsoft operating system. In 1989, Tim Berners-Lee was working on a project for the European Council for Nuclear Research (CERN), and had an idea for an information management system based on Hypertext. This idea developed into what we know as the World Wide Web (Böhm et al., 2011).

In 1990, Larry Ellison, founder of Oracle and Sun Microsystems, proposed the concept of Cloud Computing, but consumers did not like the concept of an incomplete system (Altowaijri, 2012). The application of the Cloud started to gain momentum, and the indexing of the internet in 1993 spurred this on even more. This change enabled consumers to get information that resided in the Cloud on certain websites. This internet use can be seen as the first simple form of a Cloud service offering to the public that provided information on demand. Another early service offering of the Cloud was email services. In 1996 Hotmail and later in 1997, Yahoo mail was available and provided consumers storage in the Cloud for their mails (Mokhtar et al., 2013).

In 1999, Salesforce started to provide SaaS platform services, providing users with a customer relationship management tool (Surbiryala & Rong, 2019). This service was delivered to its consumers over the internet and thus began the start of computing being sold as a utility (Sharma & Vatta, 2013). Even though Salesforce's implementation was successful, it would take some time until it caught on. Amazon in 2006 provided the next Cloud solution in the form of the Amazon S3 solution, which stood for Simple Storage Service. This solution allowed users to store and access data from anywhere over the internet. This service was seen as inexpensive, scalable, and fast. Later in the same year, Amazon launched the EC2 (Elastic Compute Cloud) service, which provided web-scale computing to developers on the same infrastructure, allowing them to run their own business (Mokhtar et al., 2013).

A key milestone in Cloud Computing's evolution occurred in 2009. Google released their Cloud enterprise applications which are browser-based, better known as Google Apps. The same year Windows Azure was released by Microsoft. Given this broader use, Web 2.0 had finally caught on, and many organisations started to provide services and applications that were browser-based (Sharma & Vatta, 2013).

2.3 Cloud Computing Architecture

The adoption of Cloud Computing has many benefits, such as on-demand service, scalability, flexibility, elasticity, reliability, increased speed time to market, and cost reduction. These benefits are delivered through the different classifications of Cloud Computing categories and service models, which are Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Software as a Service (SaaS),

Hardware as a Service (HaaS), Development, Database, Desktop as a Service (DaaS), Business as a Service (BaaS), Organisation as a Service (OaaS) and Framework as a Service (FaaS) to name a few. These services are broadly classified into three primary services - PaaS, IaaS, and SaaS. These services are delivered through 3 deployment methods, namely Public Clouds. Private Cloud, Hybrid-Cloud, and Community Cloud (Wang, Ranjan, Chen & Benatallah, 2017). These constructs are shown below in Figure 4 and Table 2 and will be expanded on in the following section.

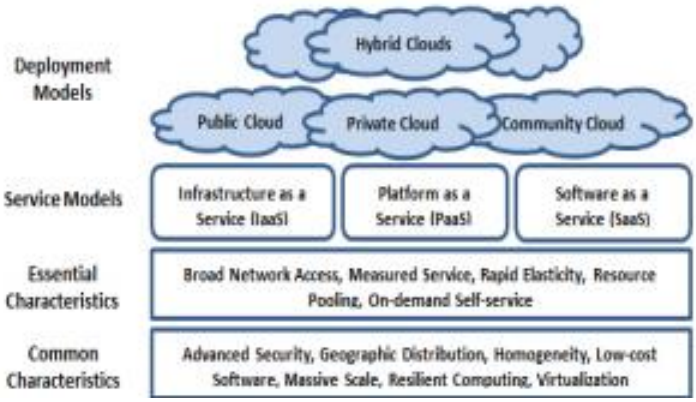

Figure 4: NIST Definition of Cloud (Ali, 2016)

2.3.1 IAAS

IaaS is a virtual layer managed and maintained by the service provider and accessed by the consumer via the internet. This layer is a hardware layer that predominantly focuses on computer resources such as processing power and storage (Mell & Grance, 2011). IaaS allows applications and software to be deployed by the consumer as well as to access the storage and operating system. However, the consumer is limited to the amount of access they have to the networking components (Olumide, 2014).

2.3.2 PAAS

PaaS is an environment for hosting applications in the different stages of development, from initiation till completion. PaaS allows for the configuration and deployment of both applications that are bought or developed to be deployed by the customers to the Cloud infrastructure (Halpert, 2011; Mell & Grance, 2011). The Cloud Service Provider will assume the responsibility of managing and maintaining the network, servers, storage, and operating system (Van Belle & Olumide, 2014).

2.3.3 SAAS

SaaS can be seen as a pay-as-you-go model that allows a consumer to run applications without the worry of managing the Cloud infrastructure. The management and control of the infrastructure become the Cloud service provider's responsibility to ensure the resource pool of servers, storage, network, and

operating systems remains operational. This support is typically managed through a service level agreement (SLA) to ensure the agreed-upon up time required by a specific organisation on their applications (Madisha, 2012).

MODELS	SERVICES AVAILABLE	USED BY	WHY USE IT	EXAMPLES
I A A S	Create platforms for service and application test, development integration and deployment	System manager	Create platform for service and application test, development, integration	Amazon EC2 , Simple Storage Service (S3),
P A A S	Services, applications tests, development, integration and deployement	Developers and deployers	Create or deploy applications and services for users	Google Application Engine, Microsoft Azure ,Force.com,Yahoo Developer Network
S A A S	Email,office automation,website testing,wiki,virtu al desktop, blog,CRM.	Business users	To complete business tasks	Salesforce.com , Animoto ,Oracle on demand,

Table 2: Cloud Service Model Providers (Olumide, 2014)

These models are stored in data centers where hardware is contained, forming the foundation on which it operates. The deployment models can be utilised in multiple ways to offer different services to the consumer. For example, IaaS and PaaS can be utilised to offer a SaaS application service to a consumer (Olumide, 2014). Figure 5 below illustrates the Cloud service models.

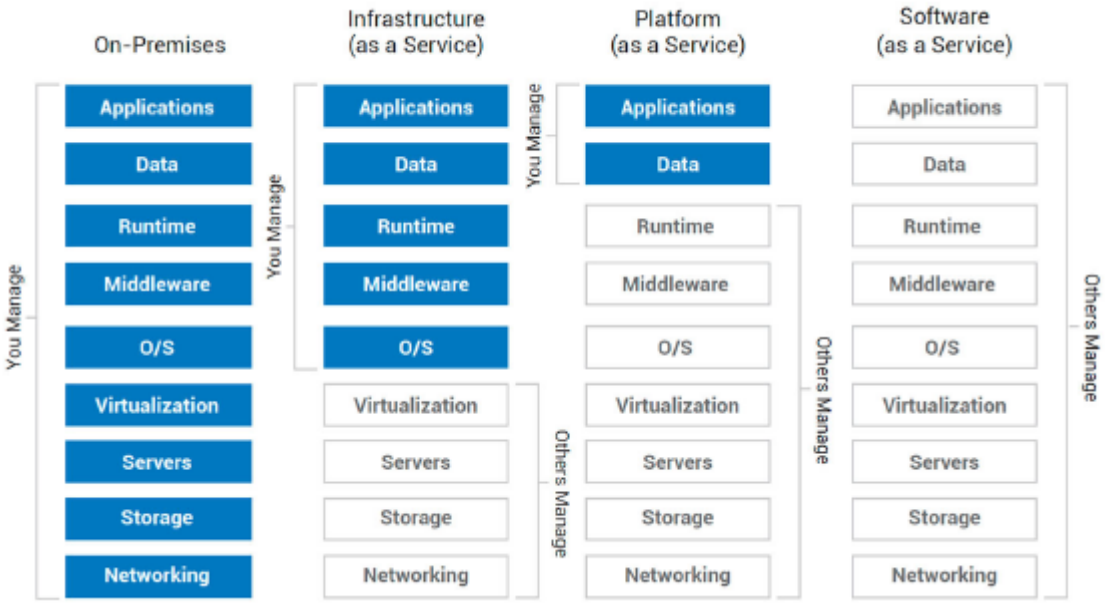

Figure 5: Cloud Service Models (Caldarelli et al., 2017)

2.3.4 Private Cloud

Private Cloud is the exclusive use of Cloud infrastructure that has been provisioned for a single organisation (AWS, 2020; Mell & Grance, 2011). A private Cloud can be configured in multiple ways, such as having its servers on-premises or off-premises located with a vendor (Olumide, 2014). This enables the organisation to have the option to manage the infrastructure themselves or transfer its management and responsibility to the service provider/ third-party vendor (Van Belle & Olumide, 2014). Figure 6 below illustrates the Private Cloud deployment model.

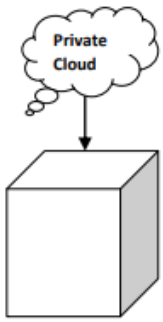

Figure 6: Private Cloud Deployment Model (Verma, 2014)

2.3.5 Public Cloud

A public Cloud is a Cloud infrastructure that has been provisioned for the general public to utilise. This Cloud model's management, operation, and ownership may be variable, and it may be owned by a combination of business organisations, government institutions, and or academia (Mell & Grance, 2011; Microsoft, 2020). The public Cloud is a shared resource pool that is used by all these organisations, of which the organisation is only charged for the resources that they utilise (Olumide, 2014). The control of this type of Cloud is with the Cloud provider as the infrastructure resides with them (Van Belle & Olumide, 2014). Figure 7 below illustrates the Public Cloud deployment model.

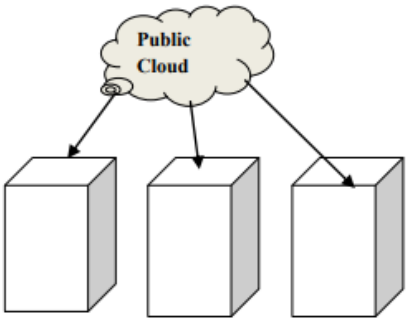

Figure 7: Public Cloud Deployment Model (Verma, 2014)

2.3.6 Hybrid Cloud

Hybrid Cloud incorporates multiple deployment models such as public, private, and Cloud community, which are combined to establish the sharing of data and applications through a standardised technology. These models remain their own individual entities even though they are bound. In most cases, this Cloud

model is composed of internal Clouds that incorporate capacity thresholds during the high-demand period (Hsu. W, 2012; Mell & Grance, 2011). Organisations can separate which data can be saved in specific Cloud locations, such as having sensitive data stored on a private Cloud and non-sensitive data stored on a public Cloud (Olumide, 2014). Figure 8 below illustrates the Hybrid Cloud deployment model.

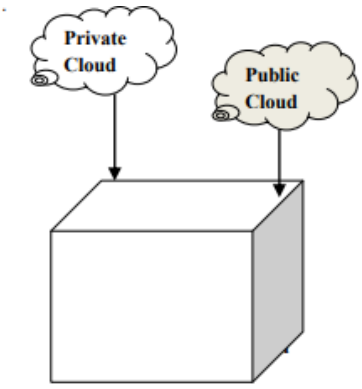

Figure 8: Hybrid Cloud Deployment Model (Verma, 2014)

2.3.7 Community Cloud

A community Cloud is a Cloud infrastructure exclusively provisioned for the use of a specific community (Mell & Grance, 2011). Two or more organisations with objectives and similar-minded goals are combined to compose this Cloud model. The infrastructure for this Cloud model could be located in a single organisation, across multiple organisations, or it could be located with a service provider (Van Belle & Olumide, 2014). The organisation has the option to manage the infrastructure themselves or to transfer the responsibility of the management to the service provider/ third-party vendor (Olumide, 2014). Figure 9 below illustrates the Community Cloud deployment model.

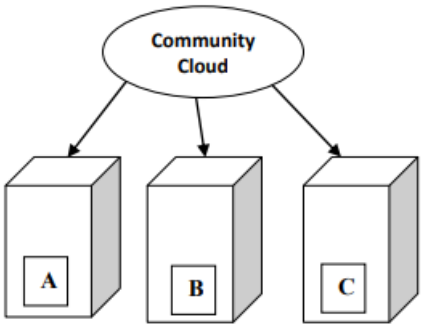

Figure 9: Community Cloud Deployment Model (Verma, 2014)

2.4 Benefits of Cloud Computing

Cloud Computing benefits are the main drivers for the adoption of the technology. However, recent published thesis and documents no longer focus on the benefit of Cloud Computing as a whole as it is assumed to be derived from its characteristics. Cloud Computing benefits is now focused on specific

implementation types, how it is derived from the specific deployment method, its service model, as well as the benefit of the particular service that would be utilised in the Cloud as opposed to on-premises (Oliveira & Martins, 2011). Major Cloud providers such as Microsoft and Amazon have identified what they deem to be the primary benefits to organisations when adopting Cloud Computing. These benefits will be discussed below.

2.4.1 Cost Reduction

Cost reduction is one of the primary adoption factors of Cloud for organisations (Xue & Xin, 2016). This benefit is of great importance as government spending has been at the forefront of the Department of Treasury concerns. In the 2020/2021 period, there has been an increase in the gap between the revenue collected and the expenditure of government entities. This factor has placed significant pressure on the government to make adjustments in expenditure and reduce costs (BusinessTech, 2021). This pressure has brought about implementing austerity policies within the government to curb unnecessary spending and reduce costs in areas such as the public sector wage bill, housing, upgrading of roads, and public lighting (Sibeko, 2019).

The implementation of Cloud Computing removes the upfront costs of buying hardware and software as well as the configuration and maintenance of on-site data centers and can be used as a pay-as-you-go solution. The admin of racking servers, utility cost, and employment of technical experts is removed from the organisation (Olumide, April, & Van Belle, 2013; AWS, 2020; Microsoft, 2020). This makes Cloud a perfect option for businesses that are just starting and entering the market to implement their services with minimal capital investment or reduce costs in some areas of IT in larger enterprises (Ali, 2016).

2.4.2 Increased Agility

The ability to provide services by government entities to its citizens has been a significant problem in recent years. This has caused an increase in service delivery protests due to the lack of or poor services provided. In addition, easy access to government services has also been at the center of these protests, which significantly affects the poorer social-economic groups (Ngcamu, 2019).

Agility for an organisation is required to remain relevant and competitive in the market; however, in the case of government, it allows them to provide services to its citizens more rapidly. This benefit is imperative for an organisation to ensure that it can pivot and change to cater to consumer needs. Cloud Computing allows organisations to deliver services in a shorter time as it can be utilised as a tool for rapid development (Xue & Xin, 2016). Even though hosted by a third-party vendor, Cloud Computing provides on-demand self-service resource provisioning of computing services in minutes. This removed the requirement for an organisation to perform capacity planning (Olumide, April & Van Belle, 2013; AWS, 2020; Caldarelli et al., 2017; Microsoft, 2020).

2.4.3 More Flexibility

The International pandemic of the Novel Corona Virus, also known as COVID-19, has forced many, if not all, organisations to change and transform the way they do their business and how people interact with their surroundings while performing day to day tasks (WHO, 2020). Organisations and government had to explore implementing solutions to assist socially distancing citizens in their homes due to the pandemic, to remain connected, perform their work, and receive services (DHET, 2020).

Cloud Computing allows an organisation's employees to be more flexible in and out of the work environment. It allows for business to take place anywhere, access data, and allow employees to work remotely (Xue & Xin, 2016). Cloud allows collaboration from any place, at any time, as if work was being completed in the office. The service will be available as long as there is an active internet connection (Ali, 2016).

2.4.4 Better Global Scale

In 2013, one of the government entities, SARS (South African Revenue Services), had website issues the first few days of the tax season due to high traffic caused by an influx of citizens eFiling returns. This increase in users causes applicational delays and limitations on access to the site (IOL, 2013). A similar issue occurred in the USA (United States of America) in 2017 with the Office of Government Ethics (OGE) website. This site crashed twice in less than a month due to increased inquiries into their system (Selyukh, 2017).

Global scale refers to the capability for an organisation to increase its scale elastically. Scalability was not possible in traditional IT solutions, which caused organisations frustration as they could not meet the demands of their clientele. Now, with the aid of a business analyst, they are able to predict when these IT resources are needed, where they are needed, and provision it as necessary. This enables organisations to deliver the required amount of IT resources (computing power, storage, bandwidth) when required and in the geographic location (Olumide et al., 2013; AWS, 2020; Microsoft, 2020).

2.4.5 Reduction in Staff Reliance

Cloud Computing removes the requirement for a few of the routine IT tasks such as hardware and software installation, software patching, and other associated tasks to be completed by the organisation. Removing these IT administrative tasks allows IT teams to focus on other organisational business goals (Olumide et al., 2013; AWS, 2020; Microsoft, 2020). This also reduces the amount of staff that might be needed in government. This reduction of staff, in turn, adds to the cost-benefit of Cloud Computing. Additionally, the scarce IT skills required to manage IT infrastructure and systems and the higher salaries that come with these resources are mitigated further.

This reduces the need for the public sector to compete with the private sector to obtain skilled resources. There is currently a considerable skills shortage in South Africa, the skills pool is significantly limited, and public sector entities cannot attract and retain these skills due to the higher paying offers from the private sector (DPRU, 2007).

2.4.6 Increased Performance

The government has depreciated legacy equipment that requires constant upgrading and replacement, which has become a reoccurring cost. This also becomes difficult to manage and maintain due to limited budgets for these upgrades. This equipment is not replaced periodically in some circumstances as required; thus, the organisation is left with depreciating legacy equipment due to financial constraints (Microsoft, 2017). Therefore, the government does not always have the latest technology available, or in some cases, not the most suited technology.

Cloud Computing allows an organisation to operate on the latest generation computing hardware in a secure data centre supplied by and managed by a vendor. Having multiple datacentres provides an organisation with reduced latency in network speeds for an application that resides in the datacentre and more significant economies of scale (Olumide et al., 2013; AWS, 2020; Microsoft, 2020).

2.4.7 Better Reliability

Cloud Computing delivers reliability by establishing measures to ensure that the service is operational 24/7, even when the service provider must perform its maintenance services. This is achieved through a strategy of storing an organisation's data in more locations to mitigate any unexpected service interruptions (Widyastuti & Irwansyah, 2018). Cloud Computing allows for multiple mirrored copies of organisational data onto redundant third-party sites to ensure easy business continuity and disaster recovery (Olumide et al., 2013; AWS, 2020; Microsoft, 2020). The ability for an organisation to recover their data back quickly due to the multiple mirror copies reduces the cost of operations (Ali, 2016).

2.4.8 Increased Security

Cloud Computing providers offer technologies and controls to strengthen an organisation's security posture. This secures and helps protect the organisation's infrastructure and data from potential threats (Olumide et al., 2013; AWS, 2020; Microsoft, 2020). Further to this, the vendor has the skilled resources that government does not possess to act on their behalf due to the lack of skills within the organisation. This gives greater security oversight to technology landscapes in government organisations (Microsoft, 2017).

2.4.9 Green Technology

Cloud Computing is widely starting to be considered a green technology as it is environmentally friendly by reducing the usage of electricity (Widyastuti & Irwansyah, 2018). Cloud can minimise the average energy consumption rate of a PC by 90% and reduce carbon emissions associated with energy consumption. However, greater emphasis is currently being placed on data centres and how they impact the environment (Ali, 2016).

Reduction and reliance in the utilisation of electricity in South Africa have been of grave concern to the Public and Private sectors and external investors. The problematic supply of electricity within South Africa due to higher demand than supply has caused a phenomenon known as Loadshedding. Centralising systems can reduce the impact of high demand on the national grid (Govender, 2016).

It was also observed that the decrease in travel due to the pandemic has also decreased the NO2 concentrations in the world. In China, due to its strict social distancing policy, it had an impact on its economic activities. This resulted in reduced power plant production, halted manufacturing facilities, and decreased need to travel via a personal vehicle. As seen in Figure 10, it was observed in Wuhan, NO2 dropped by 22.8µg/m3, and in China as a whole, it dropped by 12.9µg/m3 (Zambrano-Monserrate, Ruano & Sanchez-Alcalde, 2020). Many organisations remain operational as they turn to Cloud Computing to ensure they remain operational without the need to travel.

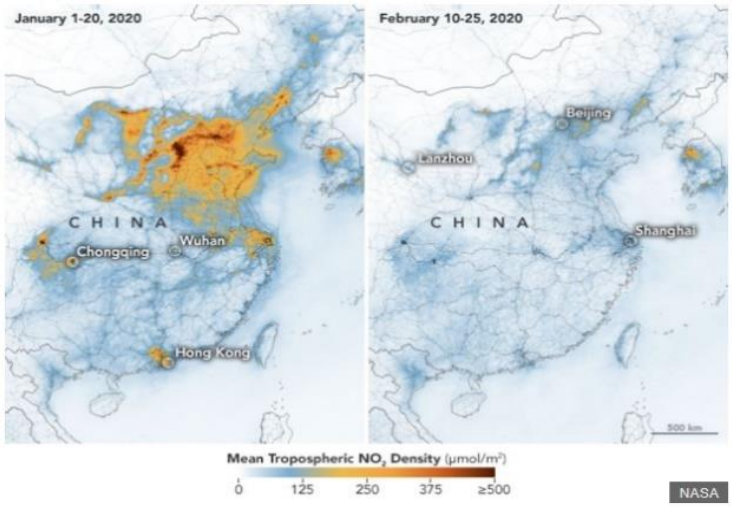

Figure 10 **NO2 Reduction (Zambrano-Monserrate et al., 2020)**

2.5 Challenges of Cloud Computing

Cloud Computing has been praised for assisting many organisations to perform their business. However, despite all of the benefits associated with Cloud, it also has its shortcomings that need to be taken into consideration when adopting Cloud Computing. Cloud attacks are an extremely massive concern; if the Cloud is not provisioned and secured correctly, it is left vulnerable to being intercepted by hackers or infected by malware (Ali, 2016). These challenges will be discussed below.

2.5.1 Security and Privacy Concerns

Challenges with security and privacy are core concerns for organisations and the possible lack of transparency from the Cloud provider (Verma, 2014). Cloud providers must ensure that there is adequate protection and confidentiality for organisational data and information. Proper security should be in place for all three layers of the Cloud platform (software security, platform security, and infrastructure security) (Ali, 2016)

Due to the pandemic, some public organisations had to allow their employees to work from home without properly implementing security architecture and policies. Scammers and malware purveyors took advantage of this fact, knowing that around 25% of people have not applied critical patches. The Internet Crime Complaint Center, which the FBI runs, received 3,000 - 4,000 complaints per day; this is a massive spike from its previous typical daily intake of 1000 before COVID-19 (Cimpanu, 2020).

A statement released by Perimeter81 indicated that the main concerns are of allowing an employee to work from home during the pandemic was that home Wi-Fi networks had not been appropriately secured, or protocols are too weak, Phishing Scams being sent to employees via deceptive emails, and insecure passwords which are used across platforms and are easy for hackers to break (Rubinstein, 2020).

As seen in Figure 11, a survey performed by Spiceworks indicated that 61% of employees working remotely with company devices connect to public Wi-Fi networks at locations such as coffee shops (Feather, 2019). A whitepaper by Cisco shows that many employees engage in behaviours that pose a risk to their organisation. The survey found that 29% of employees do not have proper security on their personal device that they use for work, 46% of employees use company devices to store personal files, which has the potential to be malicious, and 21% of employees allow their company device to be used by other people (IDI, 2020; iPass, 2017).

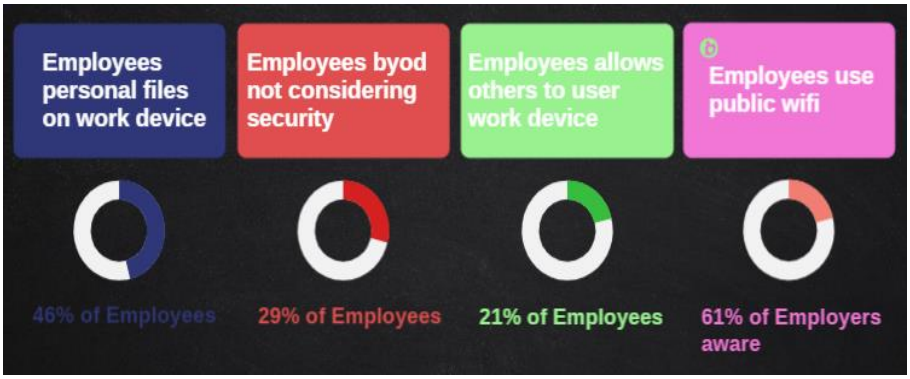

Figure 11 **Security Challenges Summary**

Devices located off-premises would not be as protected as in the organisation and therefore requires additional security and protection of corporate data (Morrison, 2017). A survey conducted in Switzerland in April 2020 of 1,500 residents indicated that 26% of respondents would withhold vital company information if they had lost their jobs. This has been highlighted as a need for a company to take preventative measures to ensure that company data and intellectual property are retained and secured (Deloitte, 2020).

2.5.2 Distrust in Vendor and Data Mangement

Trust is a more significant factor for Cloud adoption. Organisations must be able to trust a provider with their information and be able to rely on them to perform actions to which they have committed. This trust is also extended to third parties to which the provider might outsource parts of a service. This lack of trust is one factor that keeps an organisation from moving to the Cloud (Gupta, Saxena & Saini, 2016). Studies have found that trust issues in the Cloud are even more complex, as Cloud providers are not seen to be transparent (Osembe & Padayachee, 2016). Some of the issues that organisations are concerned about are:

- Service providers need to make their data handling process transparent to the customer organisations to gain their trust (Zissis & Lekkas, 2012).

- Cloud Computing makes multiple copies of an organisation's data in multiple locations to ensure high availability, which poses a risk. This can lead to data being stored in unknown locations and countries that breach an organisation's data governance. (Verma, 2014)
- Concerns of confidential and sensitive data being exposed to external parties (Khan, 2016).
- Due to a service provider outage, corporate data will be lost or inaccessible (Olumide, 2014).

Some of these concerns have come to fruition; this was revealed in a survey by Ermetic, which shows that 63% of those that responded reported that they had sensitive data exposed in the Cloud. What is further worrisome is that 98% of all respondents reported some kind of security breach that had transpired in the last 18 months (Ermetic, 2021).

2.5.3 Increase in unexpected Cost

Adopting Cloud requires the organisation to accurately determine the cost in order for the model to be feasible and visible. Costing models aid organisations; however, the organisation should consider the comparative cost of remaining on hardware systems or moving to the Cloud. This costing must take into account higher increased expenditure on bandwidth to enable the remote business feature (Ali, 2016). However, this is done poorly by organisations as it has been found that they do not have a sufficient understanding of their IT expenditure (Chihande & van der Poll, 2017). These poorly planned Cloud adoption strategies and decisions have further increased the operational costs of pre-adoption (Gupta et al., 2016).

This issue does not sit squarely on the shoulder of the adopting organisations but is partly due to how vendors offer the service. Service providers' billing models have become more complicated with layered options and intrinsic combinations that take very long to understand and select the appropriate solution. This is further exacerbated as service providers release new services, price reductions, new feature sets, and in some instances, change the pricing model completely. Due to this excess of architecture and options, the same application can have very different costs due to the services or components selected. This complexity also makes Cloud billing very granular, creating line items that can go into the thousands even when Cloud consumption is minimal. (Meinardi & Clayton, 2020). All these factors have shifted the organisation's focus, as seen in Figure 12, to reducing Cloud expenditure, from the previous primary focus of concern, security.

***Figure 12** Post-Adoption Challenges*

Gartner forecast that in 2021 public Cloud services could reach 396 billion and grow by 21.7% in 2022 to $482 billion. It is further forecasted that by 2026 this spending will exceed 45% of all enterprise IT spending (Anderson, 2021). However, these reports do not reflect how much of this spending was planned compared to what was unexpected. As seen in Figure 13, two of the main factors organisations are focusing on are reducing the cost and moving more systems into the Cloud. The more Cloud systems are implemented, it appears to become a cycle of continuous cost optimisation.

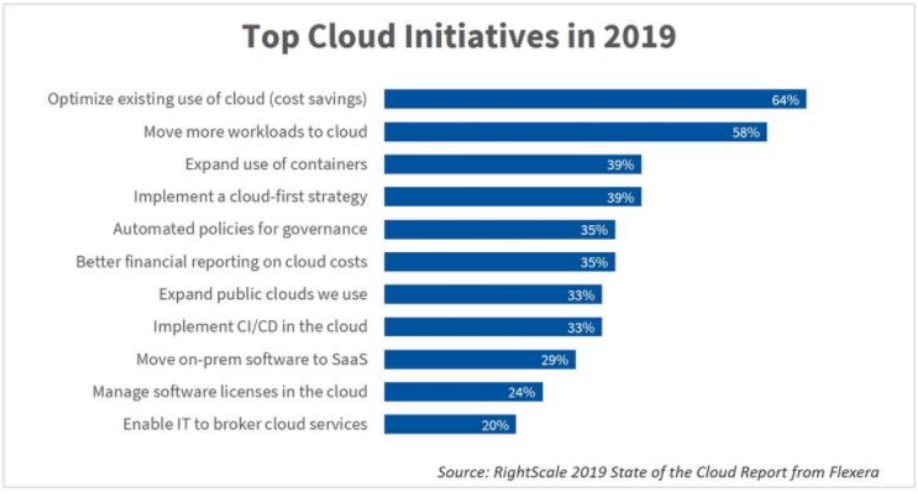

***Figure 13** Organisational Cloud priority (Dignan, 2019)*

Managing Cloud costs for an organisation has become a full-time job, much more time-consuming and complicated than what was required prior to Cloud adoption, a one-time payment. All this can overwhelm anyone easily, given the vast catalog of Cloud services available. This has created a massive overhead in operations and responsibility for organisations, reducing CIOs ' and CFO's ability to focus on delivering their services to their citizens, which has constantly changing needs (Scott, 2018).

2.5.4 Internet Dependency

For an organisation to be able to take full advantage of the Cloud model, an organisation and its employees must always have a computer or mobile device that has an active, high-speed internet connection that is stable. This dependency on having a stable connection to the internet can become problematic for organisations due to the current ICT infrastructure that is in place in South Africa (Verma, 2014).

The South African government has cited that the absence of affordable high-speed broadband is a significant inhibitor for further Cloud Computing adoption as there is no guarantee to ensure effective operation with Cloud services (Microsoft, 2017). South Africa was previously reliant on the privately-owned SEACOM cable, which provides its internet access. An additional four submarine cables have been added to this in recent years, which has brought about a decrease in the high costs of data. However, these changes have still not reduced the cost of data to be affordable due to the lack of regulatory factors (Gillwald & Moyo, 2013). This high cost does not only apply to mobile data, but it also applies to fibre connectivity; compared to other countries, fibre is costly in South Africa. A survey by Picodi indicated that out of 233 fibre providers across 62 countries, South Africa was the most expensive, with home users paying the most for a 100Mbps fibre connection (Caboz, 2019). Some entities, such as the Department of Science and Technology, sourced its own 10 GPs circuit on the SEACOM cable for the Tertiary Education and Research Network (TENET) to help reduce costs to aid in achieving the technical conditions for Cloud Computing (Gillwald & Moyo, 2013).

The cost of the internet is, however, not the only inhibitor for getting access to the internet. Due to past Apartheid policies, ICT infrastructure was not adequality implement, especially in rural areas, which negatively impacts Cloud services in some areas (Mashinini, 2008). Over time the lack of infrastructure has improved in some areas, with the Western Cape and Gauteng Province having good coverage. However, this has not transpired across all provinces, with 78.1% of Limpopo and 69.8% of Eastern Cape still having poor internet access due to poor ICT infrastructure (Odendaal, 2015).

2.5.5 Human Resource Issues

The implementation of Cloud Computing can cause technical support staff to become disgruntled in their work. This is due to the fact that work that they previously performed may now be rendered by external parties or no longer needed. Thus the staff may feel like their position has become obsolete and left to do menial tasks to aid external support to troubleshoot. This will create the fear of the possibility that they may lose their jobs (Olumide, 2014).

2.5.6 Technology Readiness Issues

For an organisation to deploy an innovation, it must ensure that it has put the appropriate measures to adopt new technology. Technical infrastructure such as network technologies and enterprise systems must be compatible to ensure the best utilisation of the innovation. If the infrastructure is not ready, it can negatively influence the adoption of new technology. Therefore technologically ready organisations are more prepared for Cloud Computing adoption (Alhammadi, Stanier & Eardley, 2015). Public sector

organisations are plagued with depreciating legacy equipment. This is due to slow modernisation and diminishing capital for infrastructure upgrades (Gillwald, 2017).

2.6 South African Public Sector

2.6.1 SITA'S Role in ICT

The public sector has been seen as the leading consumer of ICT's and a key stakeholder in increasing the awareness and trust in Cloud-based services for the private sector. Unlike the private sector, the public sectors Information Technology is governed by the SITA Act. This act mandates government organisations to procure all ICT's and related services through the State Information Technology Agency (SITA) as their primary vendor or supplier. The State IT Agency was established to be the central point for all IT requirements and act as the channel that government organisations request services from other IT industries (Government, 1998)

One of the main functions of SITA is to find and champion technologies that will aid in making government more efficient. This brought on the early adoption of e-commerce and e-government in South Africa. However, this adoption rate has decreased due to slow modernisation of ICT infrastructure, depreciating legacy equipment, and policy gaps. Further to this, information systems are decentralised in the three branches of government, namely National, Provincial, and Local. There is currently a limited pool of skilled resources within the public sector, compelling it to leverage off the private sectors to assist in Cloud Computing services and support (Gillwald, 2017).

Currently, the Public Sector is lagging behind the Private Sector as well in comparison to other global counterparts in its advancement of ICT adoption, which includes Cloud Computing. This has been partly due to the suboptimal service delivery by SITA, which has resulted in a satisfaction rating of 35% in the 2014/2015 financial year. One of the main issues that have been cited was the lengthy turnaround times received when procuring ICT services. SITA has acknowledged its shortcomings and has taken steps to try and address them when rendering its new strategy to provide the Public Sector with a better E-Government and E-service experience (Microsoft, 2017). In 2018, SITA announced that it has now set out to be the provider of Cloud infrastructure for a government organisation, making it one of the largest government-private Cloud infrastructures (Rajgopaul, 2018).

2.6.2 ICT'S and Government

The relationship between ICT's and Government is not something new and has been interconnected since the 1970s. The term E-government is something a little newer, which is derived from the internet boom and has been in use since the late 1990s. The primary distinction between these two concepts is that E-government focuses on how ICTs are used to provide services to its citizens (Grönlund & Horan, 2014).

There is currently no standard definition of E-government, as the definition used in some cases links up to the country's strategy and how they intend to utilise ICTs to achieve these goals. Some definitions found are listed below:

- United Nations definition: “the use of ICTs to more effectively and efficiently deliver government services to citizens and businesses” (UN, 2021, para. 7).
- European Union definition: “the use of ICT in public administration combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies” (Ardielli & Halásková, 2015, p. 4).
- South Africa’s definition: “refers broadly to the innovative use of communications technologies (including mobile devices), websites, applications, and other ICT services and platforms to link citizens and the public sector and facilitate collaborative and efficient governance. A digital government uses ICTs and digital technologies to make government processes more efficient, strengthen public service delivery and enhance participation by citizens in governance” (DTPS, 2016, p. 118).

A primary influence on this definition of South African’s E-government definition is the Batho Pele Principles. These are the eight principles on which South Africa bases its service delivery in the post-Apartheid era. One of these principles states that its citizens should receive access to integrated service delivery offerings, which has helped to spur on the digital transformation of how government delivers its services to ensure all its citizens have equal, impartial, and equitable access (Murenzi & Olivier, 2017).

According to the 2017 National E-government Strategy and Roadmaps, there are four categories of E-governments, namely Government to Government programs (G2G), Government to Citizen programs (G2C), and Government to Business programs (G2B). Within these categories, ICTs are utilised to link the public sector to its citizens and create collaborative and efficient service delivery (DTPS, 2017).

The 2017 strategy was developed as the government observed a change in how rapidly economies were digitising. Service was increasingly accessed in both the private and public sectors through digital platforms; thus, service delivery models were needed to be adjusted. Thus, it became clear for the South African government that if they wished to remain effective and relevant, policies and frameworks were needed to be established, which were citizen-centric and supported other policies already in place. This brought about the creation of the National Policy on Data and Cloud in 2021, which sought to encapsulate all previous policies and whitepapers and proved a framework for the use of the Cloud in South Africa (DCDT, 2021). The National Policy on Data and Cloud highlights specific areas in which it perceives that Cloud Computing adoption will benefit and improve known areas of issues with the government's ability to deliver services as well as areas of concern with its implementation.

2.7 Adoption of Innovations

The phenomenon of why organisations adopt any new innovation has been of interest to researchers for many years. This interest has brought about many adoption theory’s, models, and frameworks such as Technology Adoption Model (TAM); Technology, Organisation, and Environmental (TOE) framework, Theory of Reasoned Action, and Innovation Diffusion Theory, to name a few, to help understand the psychology behind why organisations adopt innovations (Kim, Y & Crowston, 2011).

Adopting an innovation is typically initiated out of a realisation that a need exists and needs to be addressed. This moves the potential adopter to search for a potential solution that addresses this need,

leading to adopting and implementing the solution (Wisdom, Chor, Hoagwood & Horwitz, 2014). There is an inherent perception that there is a benefit that comes along with the adoption of the innovation, and the chosen innovation would bring the most benefit in comparison to alternate solutions. This perception is also influenced by the perceived compatibility, complexity, and trialability, which amalgamates into a perceived evaluation of the solution. In addition to this, external factors such as remaining on the competitive pressures, social influences, or providing services to its customers can drive an innovation adoption (Frambach & Schillewaert, 2002).

The adoption of an innovation can be summed up into 3 phases, namely pre-adoption, adoption, and post-adoption. In the pre-adoption stage, performance expectancy, which can also be seen as perceived usefulness, is a critical factor in this initial stage. This factor forms an attitude within the adopter which influences their intention to move to the subsequent adoption stage. The following adoption stage only progresses if the adopter is satisfied and perceives the innovation as useful. The adopter thus forms the intention to adopt the innovation and implement it (Kim, Y & Crowston, 2011).

The post-adoption stage is heavily dependent on the perceived performance to measure and influence success confirmation. If the perceived performance is less than expected, it can be considered unsuccessful. If the perceived performance is as good or better than expected, it can be considered successful (Liao, Chen & Yen, 2007). During the use of an innovation, the adopter's perception develops as they gain experience, which can alter the adopter's evaluation. Other external variables and stimuli can influence the adopter's attitude and thus their behaviour of usage of the innovation. The continued use of the innovation is seen as the adopter's attitude towards the innovation as positive or satisfied (Frambach & Schillewaert, 2002; Kim. S & Malhotra, 2005). The adopter's satisfaction with the innovation is a critical factor to ensure its continued use. If this variable becomes negative during its use, the adopter may stop the use of the innovation (Kim. Y & Crowston, 2011).

2.8 Adoption Models

The South African public sector has indicated that the adoption of ICT's is a vital component to aiding in the development of the country. As mentioned in section 2.6.2, a strategy has been created by the Government to formalised the adoption of Cloud Computing in the public sector (Microsoft, 2020). In the Adoption of Innovations section, many model and frameworks were mentioned that can be used to exam technology adoption. Literature indicates that models which focus on the firm-level are currently few, and literature comparing these models is even fewer (Oliveira & Martins, 2011). The TOE Framework has been found to be utilized by multiple researchers in a variety of ICT's and industries to determine the factors of adoption (Klug & Bai, 2015). A critical consideration of the chosen framework was the consideration of environmental factors due to public organisation being mandated by law to utilized SITA to provide their ICT's. The models that were chosen for the empirical research were the TOE Framework, the Iacovou et al. (1995) model, and Research Model (Hassan, Nasir, Khairudin & Adon, 2017). The models are further discussed below.

2.8.1 TOE Framework

Technology-Organisation-Environment (TOE), as seen in Figure 14, is a framework that is utilised to comprehend phenomena in the adoption of technologies within an organisation. To better understand the many factors of adoption in Cloud Computing, the TOE framework will be utilised to aid in understanding these factors in the context of technology, organisation, and environmental. The technological element is made up of not only equipment and technologies internal and external to the organisation but also processes. The organisational element focuses on the characteristics and resources. The size of the organisation, its managerial structure, human resources, the degree of centralisation and formalisation. The environmental element looks at the industry structure and what size it is, its competition, the context of the economics, and the regulatory factors (Depietro, Wiarda & Fleischer, 1990; Oliveira & Martins, 2011). This adoption framework will be used to identify all the factors that would have been considered in the adoption of Cloud Computing. These same factors will be explored to identify how and if they have changed in the post-adoption of Cloud Computing. Each of these elements will be elaborated on further below.

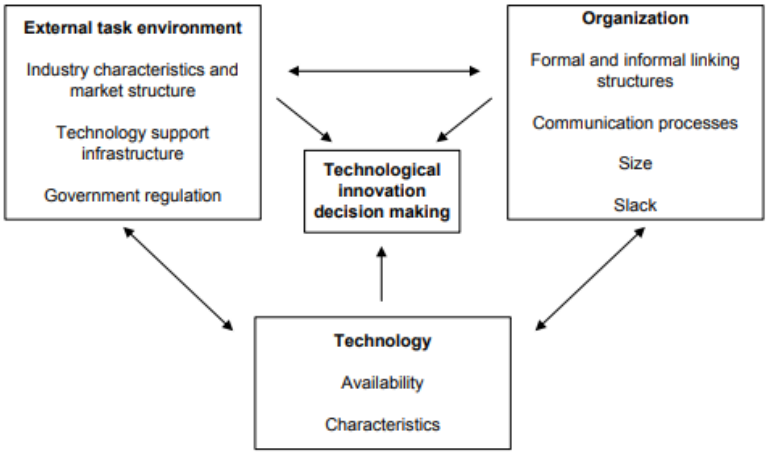

Figure 14: Community Cloud Deployment Model (Tornatzky & Fleischer, 1990)

2.8.1.1 Technological Context

The Technology in the TOE framework refers to the characteristic of an organisation that enables it to adopt technologies, for instance, cost-benefit, relative advantage, compatibility, and complexity (Ali, 2016). The Technology context must also take into consideration whether or not the technology is only perceived to be useful or if it is actually fit for purpose (Rosli, Yeow & Siew, 2012).

Technology should provide the organisation with a relative advantage, which will allow it to be superior or more advanced than other technologies of its competitors. This innovation should be easy to utilise and easy to integrate as it must be compatible for organisations to adopt. However, this change comes with some uncertainty as innovation has some ambiguity in its utilisation as it is unknown (Ali, 2016; Olumide, 2014).

2.8.1.2 Organisational Context

The Organisation in the TOE framework refers to the available resources that are required for innovation adoption. These resources can be seen as the organisation's structures for decision making or top managements communication processes, human resources, its culture, and the readiness to adopt new innovations (Rosli et al., 2012).

Organisations are characterised by their size, workforce, and capital value. The size of the organisation adopting an innovation is vital in gaining acceptance; however, in comparison, smaller companies are more flexible in adopting new innovations (Ali, 2016).

Top management support is vital for the successful implementation of an innovation. One of the ways management can support is by allocating resources to ensure the innovation can take place, as well as the time invested backing and engaging to ensure the success of the innovation by incorporating it into the organisation's procedures (Oliveira & Martins, 2011). Once the proper support and resourcing are given, organisations become more innovative and have appropriately skilled employees available with knowledge of how to and what to adopt. This will ensure that the current technology is compatible and adopted with past experience (Ali, 2016).

2.8.1.3 Environmental Context

The Organisation in the TOE framework refers to how an organisation deals with its surroundings, which influences its behaviour. External influences can consist of laws and policies, pressure from external obligations, and other industry competitors (Rosli et al., 2012).

One of the core components to the adoption of innovation such as Cloud is its reliance on bandwidth, its price, and its availability. Pressure from competitors or partners is viewed as a hindrance to innovation adoption as the need to ensure stability. This hindrance is further compounded depending on the type of business's industry and sector. Studies have also found that promotional actions influence innovation adoption and acceptance. Studies that were performed earlier had tried to show the association between a consumer and the advertiser; however, other researchers reported that this has an insignificant impact on consumers (Ali, 2016)

The TOE framework has three contexts to it, namely the technological, organisational, and environmental. Compared to other firm base models, this framework provides an appropriate tool to understand the adoption of innovations.

2.8.2 Iacovou et al. (1995) Model

The Iacovou et al. (1995) model, as seen in Figure 15, was developed to analyse the components of inter-organisational systems (IOSs) that impact the adoption of innovations. This was initially explicitly used in the context of electronic data interchange (EDI). This framework has three factors: perceived benefits, organisational readiness, and external pressure. In comparison to the TOE framework, perceived benefits are an additional construct. The organisational readiness factor can be seen as an amalgamation of the TOE frameworks Technology and Organisation. Similarly, external pressure is relative to TOE frameworks Environmental factors (Hsu. P, Kraemer & Dunkle, 2006).

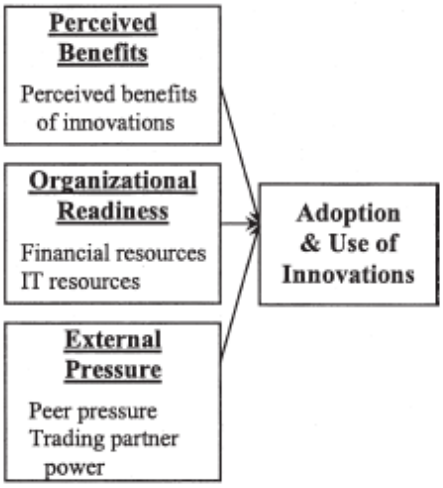

Figure 15: Iacovou et al. (1995) model (Hsu. P et al., 2006)

Perceived benefits are seen by many researchers as the expected inherent benefits when adopting an innovation (Oliveira & Martins, 2010). As mentioned earlier, the perception of an innovation is a critical factor in the adopter's evaluation of post-adoption and the continued use of the innovation. Given the many Perceived benefits associated with Cloud adoption, IT leaders are enticed to adopt the innovation by the prospect of aiding them in gaining the market advantage (Hsu. P et al., 2006).

2.8.3 Research Model (Hassan et al., 2017)

The proposed model for research contains aspects of the previous two models mentioned and is comprised of 4 factors. The first two factors are environment and organisation; these factors remain as they appear in their applicable models. The third factor is technology which is underpinned by perceived benefits. Technology equates perceived benefits as a factor that drives technology adoption. This new model is depicted in the below Figure 16.

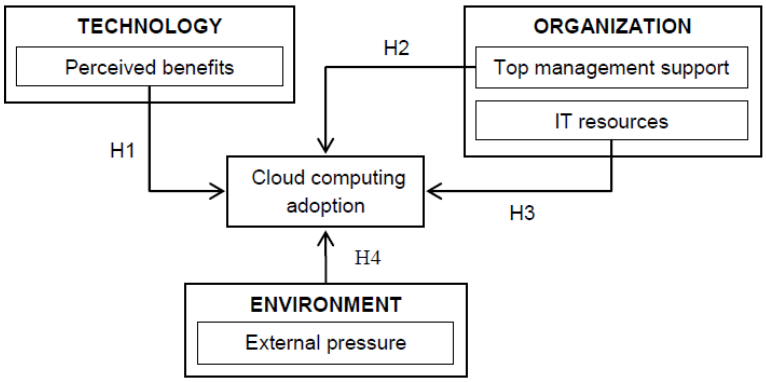

Figure 16: Research Model (Hassan et al., 2017)

This research model indicates that the technology factor has a perceived benefit and is a major driver for innovation adoption (Hsu et al., 2014). Therefore, perceived benefits have a positive relation to Cloud Computing adoption. The organisational factor has an influence on the success of the adoption. Without top management support to provide capital and resources, the implementation could lead to failure (Oliveira et al., 2014). Therefore, top management and IT resources positively affect Cloud Computing adoption. Finally, the environmental factor can be either impact adoption positively or negatively; this external pressure to perform can push an organisation to adopt technologies (Oliveira et al., 2014). Therefore, external pressure has a positive relation to Cloud Computing adoption.

2.9 Literature Summary

An organisation's adoption of an innovation is driven to address or provide a solution to a particular need. In the case of the South African public sector, Cloud Computing has been highlighted to be capable of addressing various shortcomings in its service delivery to its citizens as well as overcoming austerity measures. However, as seen in the literature, the post-adoption benefits realisation indicates that the main driver of adoption, being cost-saving, is not realised in many organisations.

The reason behind the increase in cost has been attributed to many factors such as IT managers having poor knowledge of their spending, a short-term investment increase from adopting the innovation, poor Cloud service implementation, and complex Cloud Computing service offerings. Despite adopters not achieving their perceived cost savings, Cloud adoption is still increasing and being expanded on in the Public Sector. This has resulted in a Cloud policy that mandates Public Sector organisations to implement a Cloud-first approach.

Research into the phenomena of innovation adoption and continued use has been of interest to researchers for many years. Literature indicates that an innovation will continue to be used if the adaptor is satisfied with the results they received in relation to the perceived benefits of pre-adoption. Given that there is a disparity between the pre-adoption perceived benefits and actualised benefits, the research model (Hassan et al., 2017), which has a core factor of perceived benefits, is applied to provide further insight into the research decision making process. Using this model as a guide to investigate the research question, the researcher is confident to understand better why this disparity is occurring. The following chapter will explore the researcher’s methodology and the approach that was taken to conduct this research.

3. Research Design and Methodology

In this chapter, the research design and methodology are described, which will be utilised by the researcher to answer the research question of how the South African public organisations have actualised the perceived Cloud Computing pre-adoption benefits and how they have measured this by employing real-world data. The research onion proposed by Saunders, Lewis, and Thornhill (2009) is first introduced as it will guide the rest of the chapter. The chapter is concluded with a summary of the chosen research design and methods required to conduct the research.

3.1 Research Design

Research design is the framework that the researcher utilises to gather and analyse information such as expressing casual relationships and interconnection, generalisation of individuals in large groups, and understanding behaviour (Sekaran & Bougie, 2016). Research can be defined as the methodical probing of a phenomenon in order to learn new truths and further information (Saunders, Lewis & Thornhill, 2009). This information, in turn, informs new knowledge (Hair Jr, Page & Brunsveld, 2020). The choices made in the research design are dependent on the type of study as there is no single correct design that is better than another (Sekaran & Bougie, 2016). To help guide the research, the researcher utilised the research onion as seen in Figure 17 as its framework, which implements the consideration of which philosophies are incorporated, the approach, strategies, choices, time horizon, and procedures and techniques.

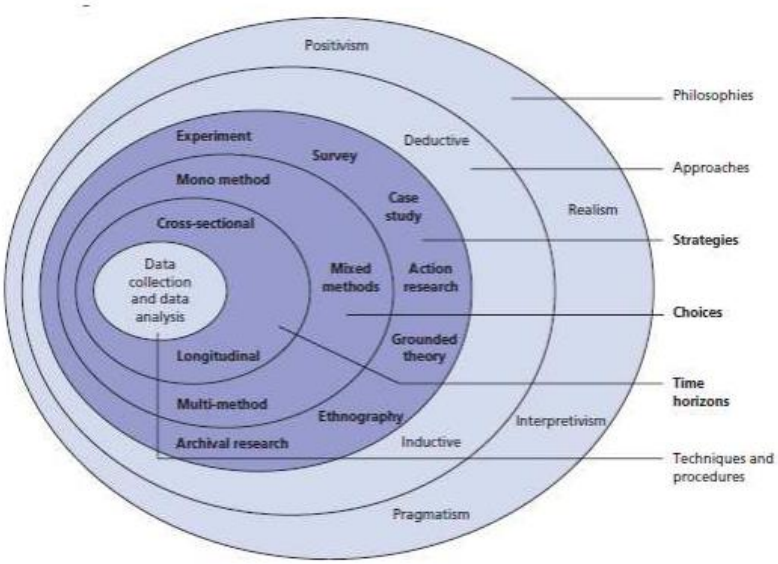

Figure 17: Research onion Saunders (Saunders et al., 2009)

3.1.1 Research Philosophy

The Philosophical stance is a critical element for a researcher, as it helps ascertain what assumptions have been made about how human knowledge is perceived. These assumptions can be broken down into two dimensions or methods: epistemology and ontology, in which data of a phenomenon can be collected and analysed. The choices made by the researcher when adopting a philosophical stance are dependent on the nature of the research as well as the researcher's own philosophical assumptions (Bhattacherjee, 2012).

3.1.2 Research Ontology

The ontology of the research is crucial as it provides insight into the researcher's stance and assumptions. Ontology can be considered to be our assumptions on how we view the world, such as if we see the world to mainly consist of constant change or social order (Bhattacherjee, 2012). Ontology is split into two domains, namely subjectivism and objectivism. Subjectivism looks at actors' social interaction, perceptions, and actions. Subjectivism and constructivism are often associated with one another. Constructivism looks at the interactions of people and the environment to shape their knowledge. Objectivism looks at knowledge as being independent and external from society, its actors, procedures, and specific structures (Saunders et al., 2009). The literature review highlights that continued use of an innovation post-adoption is firmly based on adopters' behaviour. This behaviour is influenced by their perception based on their pre-adoption perceived value, which can either become positive or negative based on post-adoption outcomes. As the research encompasses the perceptions of the adopter and the multiple realities that exist in an organisation, this research aligns itself predominantly around constructivism.

3.1.3 Research Epistemology

Epistemology is the foundation on which the researcher has based their assumptions and identified which are the most appropriate methods to research the world. Epistemology is split into three views: interpretivist, positivist, and realist. An interpretivist researcher looks to understand how the role of social actors impacts the environment in which they play. A positivist researcher is concerned with the observation of a subject and the collection of data. A realist researcher's truth is subjected to their senses and thoughts and how they are presented to them (O'Gorman & MacIntosh, 2015).

The intention of the researcher was to investigate how the adoption of Cloud Computing has benefited a South African Public Sector organisation. Not many studies have been carried out in Cloud Computing post-adoption, and therefore comparative research is limited. The researcher aimed to understand what the organisation's adopters have experienced to be its benefits and what they have utilised to measure both the tangible and intangible. The researcher acknowledged that knowledge is created through experience, and this knowledge resides with the knower. As a result, this assumption of the research aligned its Epistemology to Interpretive to collect and examine data.

3.1.4 Research Approach

The approach of the research aided in clarifying what research type was required. The research approach is split into two types, namely inductive and deductive. The inductive research approach aims to establish a theory once the research has concluded. This theory would have been formulated from all the data that has been collected and the themes which have emerged from the data. A deductive research approach requires the testing of an established or pre-existing framework. This approach also allows for the explanation of causal relationships between variables and establishes reasonings between these concepts (Ghauri, Grønhaug & Strange, 2020; Saunders, Lewis & Thornhill, 2019). The researcher acknowledged that this approach aligns itself with the Inductive research approach as it aimed to develop a theory and not test a theory.

3.1.5 Research Purpose

Research purpose can be split into three categories: explanatory, descriptive, and exploratory. The purpose of explanatory is to look at and understand the relationship between one or many variables or ideas and explain the cause and effect of them. The purpose of exploratory is to clarify the understanding of a problem. The purpose of descriptive is to portray information of a subject or phenomena in an accurate manner. It is also seen as an extension of explanatory purpose research (Saunders et al., 2009). As the literature on the post-adoption of Cloud Computing is limited, there is no precise single standardised method of measuring benefits. The researcher, therefore, acknowledged that an explanatory research purpose aligns with defining problems that are not clearly defined and will increase the understanding of how adopters are currently measuring these benefits.

3.1.6 Research Strategy

The purpose of a research strategy is to enable the researcher to answer the specific research question of the study (Saunders et al., 2009). The research strategy that will be utilised to aid the researcher in answering the research question is a thematic analysis which is a form of qualitative analysis. This allows for data to be interpreted and to be classified and presented in themes. This also aids the researcher in identifying relationships and comparing between concepts in the underlying data (Alhojailan, 2012). There are two main types of thematic analysis: inductive and deductive. The inductive thematic analysis focuses on data to create strong connections to themes without having a pre-defined coding frame to reference. The deductive thematic analysis focuses on specific data details to create codes to answer a research question. The selection of the research strategy is rooted in the researcher's epistemological stance and cannot be coded outside of this (Braun & Clarke, 2012). The research strategy utilised in this research is Inductive thematic analysis, as it is rooted in the researcher's epistemology.

3.2 Research Methodology

Research methodology is the methods or instruments that the researcher employs to collect information such as questionnaires, semi-structured interviews, and observations by the researcher (Bell, Bryman & Harley, 2018).

3.2.1 Research Method

Research methods can be split into a quantitative, qualitative, or mixed-method. Quantitative methods focus mainly on data collections and analysis that is numerical in nature. Qualitative methods focus on data collection and analysis that is non-numerical in nature. It allows for in-depth and semi-structured interviews as a method of investigation. The questions in these interviews can be open-ended to allow the interviewee to elaborate further on any of their responses to a question. The mixed-method comprises of both quantitative and qualitative in its data collections and analysis, a combination of numerical and non-numerical (Saunders et al., 2009). For the purpose of this research, the researcher had selected a qualitative method as it is driven by the researcher's stance that knowledge resides with the social actor.

3.2.1.1 Research Questions

This research's interview questions were developed based on multiple inputs namely, findings from the literature, the research framework and suitability to answer the research question. The researcher also took into account that the output from these questions should align itself to attributes such as transferability, reliability, validity and credibility (Noble & Smith, 2015). The researcher thus attempted to ensure that the output regardless of who the researcher was, the outcome would remain the same. The framework played an important role is the development of the question as it provided areas of focus and the ability to create themes of questioning.

3.2.2 Sampling Method

Sampling can be defined as the technique of identifying and selecting an appropriate portion of a whole, which would be representative of its parameters or characteristics (Saunders et al., 2009). A purposive sampling method will be utilised to inform the selection process. This method is used when a researcher performs their initial studies or when specific information and expertise are required to answer the research question (Dolores & Tongco, 2007).

This research intended to study a public organisation and specific stakeholders in the information department who had been identified as critical participants for data gathering due to their involvement with the adoption and management of Cloud. The organisation also has a limited pool of participants involved with Cloud and fewer with decision-making power or knowledge of the wholistic benefit of Cloud in the public sector (Gillwald, 2017).

During the initial phase of contacting participants, the lack of employees in Cloud Computing was made evident as participants indicated they were willing to be interviewed but had no knowledge of the Cloud services. Three participants declined the invitation due to conflict of availability, and four more declined due to poor health due to COVID-19. Another constraint observed is that some vacant positions had not been filled yet of employees who recently left the organisation.

It was observed that there is a clear divide in knowledge in Cloud Strategy and its effects on the organisation at different levels. Participants at the operational level found it hard to answer questions such as expenditure and could only relay what they had heard. Participants at the strategic level did not have detailed insights into the technical difficulties in the daily operations. The sample of participants comprised of directors, technology owners, service managers, and operational staff, as seen in Table 3. Notable participants of interest are R1 and R7, who managed the adoption of Cloud Computing and are responsible for the Cloud performance of the organisation.

Interview	Identifier	Position	Portfolio	Experience in Organisation	Years in Position
Respondent 1	R1	Director	Digital Transformation	21	11
Respondent 2	R2	Service Manager	Health	17	13
Respondent 3	R3	Technology Manager	Health	14	1.5
Respondent 4	R4	Deputy Director	ITSM	18	9
Respondent 5	R5	Deputy Director	Health	8	8
Respondent 6	R6	Service Manager	Environmental Affairs	20	18
Respondent 7	R7	Director	Transversal Applications.	18	5
Respondent 8	R8	Technologist	GITO/Cloud Computing	17	2
Respondent 9	R9	Deputy Director	Transversal Systems	17	7
Respondent 10	R10	Problem Manager	ITSM	16	4
Respondent 11	R11	Technology Manager	GITO/ Exchange	17	2
Respondent 12	R12	Chief Technologist	GITO/ Backup Service	17	6
Respondent 13	R13	Chief Director	Transversal Applications	17	5
Respondent 14	R14	Lead Enterprise Architect	Governance Office	20	9
Respondent 15	R15	Chief Technology Manager	GITO/Network	17	11
Respondent 16	R16	Senior Engineer / Project Admin	ITSM	10	10
Respondent 17	R17	Helpdesk Team Lead	ITSM	19	12
Respondent 18	R18	Helpdesk 2IC	ITSM	19	2
Respondent 19	R19	Incident Response Co-ordinator	ITSM	7	1
Respondent 20	R20	Support Engineer	ITSM	7	7

Table 3: Respondent List

3.2.3 Time Horizon

The research timeframe can be split into two categories, namely longitudinal and cross-sectional. Longitudinal research is observed over an extended period, whereas research done in cross-sectional is observed in a much shorter period. Cross-sectional is seen as a snapshot of the time in which the researcher observes the phenomena (Saunders et al., 2009). For the purpose of this research, the researcher had selected cross-sectional research due to the limited time in which the results had to be captured to be presented to UCT for Master's Thesis consideration.

3.2.4 Data Collection

Semi-structured interviews were utilised to collect data for this research. This interview was being guided by a questionnaire comprised of open-ended questions. These interviews were conducted via Microsoft Teams as supplied by UCT due to the COVID-19 pandemic. In addition, e-mail was used to communicate to the organisation and participants prior to the interview to gain consent for their participation and schedule the interview time and dates.

3.2.4.1 Data Analysis Tool

Interviews were recorded and transcribed into the Nvivo tool supplied by UCT. This tool was used to perform the thematic analysis of the transcribed data and highlight the relevant themes and codes (Braun & Clarke, 2012). After the transcription process, a data cleaning process took place in which the data was anonymised.

The 6 steps as described by Braun & Clarke (2012) was followed to find patterns and themes for the purposed of coding in the Nvivo tool. Step 1: The researcher gathered all the transcripts of the interviews and carefully read through them multiple times. During this process, notes were taken of passages that stood out and which was of interest. Step 2: The text of the transcripts which formed the data was organised into codes. It is important to note that not every line of text was coded, but segment of relevant data was coded to topics which could possibly address the research questions. Step 3: These codes was reviewed further to find similarities and codes that fit together. These codes were fitted into initial broader themes, for example, benefits and challenges. Step 4: These themes were analysed and reviewed again. The intention in this step was to confirm if the themes established make good sense and relevant to the research question. Furthermore, that each theme was complete and did not belong under a different theme or if there were any overlap. Step 5: In this step, the data is further refined, and data analysed to ensure that the themes have remained true to its principle. Step 6: This marks end of the process and themes are translated into an output for the writeup of the dissertation. This data after its completion was also uploaded to the UCT's official FTP (File Transfer Protocol) site as per the new requirement.

3.2.5 Reliability and Validity

Qualitative studies are often seen to have insufficient scientific rigour and inadequate reasoning to support the use of the methods adopted. These methods appear to be a collection of the researcher's opinions and biases (Noble & Smith, 2015). Therefore, it is critical to ensure that the validity and reliability of the research are considered to assure other researchers that the findings are credible and trustworthy. Research validity is focused on the precision and accuracy of the findings. A valid study reveals the actual truth that exists, and the instrument or measure used is valid if it measures what it is intended to measure (Brink, 1993). Reliability refers to the ‘trustworthiness’ of the methods used by the researcher and the consistency it is applied while taking into the researcher's own bias. The research should be able to be conducted by another researcher and arrive at a similar or comparative outcome (Noble & Smith, 2015). The researcher acknowledged that data validity and reliability are important considerations while conducting qualitative research to ensure the phenomenon is represented accurately and truthfully.

Lincoln and Guba (1985) presented four aspects of criteria to achieved trustworthiness, namely credibility, dependability, confirmability, and transferability. Credibility is the representation of the true data by the researcher. Finding is found to be more credible when respondents describe similar shared experiences. This is also supported in terms by the Microsoft Teams recordings and transcripts from the interviews that were conducted. Dependability was created by ensuring the research questions would provide the replicable data outcomes if it were performed by another researcher. Confirmability is created by proving rich quotes derived directly from the data to support the research conclusions. This aids in negating an assumption that the viewpoints present is that of the researchers' biases. Transferability was achieved by proving enough information on the context in which the research too place and on the participants for external readers to associate the results to their own (Cope, 2014).

3.2.6 Pilot Study

A pilot study was carried out to aid in ensuring the validity and reliability of the data. This pilot study was utilised to refine the questions the researcher asked the research participants. The pilot study comprised of a small group outside of the defined scope of selected participants. This allowed the researcher to assess if the questions were suitable and straightforward for a participant to answer and if the data collected answers the research question. From this pilot study, the researcher cleared any ambiguity in the questions.

3.2.7 Confidentiality and Ethic Approval

The researcher applied for ethics approval from the UCT Ethics Committee to carry out this study. Once approval was obtained, the researcher contacted the relevant organisation and arranged the interviews. Prior to the interviews, the researcher sent consent forms from the organisation and participation forms to indicate their agreement to be included in the study. This letter disclosed the purpose of the study and its ethical consideration. It further informed the interviewees that their participation was confidential, anonymous, and voluntary.

3.2.8 Limitations

This research encountered some limitations during the data collection phase. The interviewee's participation was limited due to availability brought on by COVID-19. Many participants had postponed interviews multiple times due to having to fill in for other colleagues who had taken ill, they themselves had taken ill, and some had died before the interview could occur. Interviews were only conducted via teams due to COVID-19 concerns, which posed an issue as some interviews had to be postponed due to inadequate bandwidth. Many respondents also chose not to put on their camera, which did not allow the researcher to observe physical behaviour while responding to questions. Connectivity issues caused the researcher to repeat questions or for the participants to repeat their responses. It was observed that the repeated responses were not as in-depth as the initial response; thus, some responses are not as expansive as they possibly could be.

4. Findings and Analysis

The main objective of this research was to understand how perceived Cloud Computing pre-adoption benefits within a South African public organisation have been actualised and how they have measured its success.

Utilising thematic analysis, participant responses were analysed to find applicable themes. A total of 15 themes arose from this process. Each of these themes was allocated to a corresponding central theme according to the model by Hassan et al., 2017, described in the research section, namely Technology, Organisation, and Environment. The findings of these themes are discussed in more detail in the following section. The researcher utilizes rich quotes of participants as support after each conclusion depicted.

4.1 Technology Factors

Under the major theme of technology factors, a total of 8 themes was identified. The most significant of these themes under this section was agility, as per the below Table 4. This breakdown also aims to answer the sub-questions and attempt to identify how the organisation has changed and benefited from the adoption from a technology point of view.

Technology	Satisfied with Agility	Satisfied with Flexibility	Satisfied with Reliance	Satisfied with Reliability	Satisfied with Security	Satisfied with Performance	Satisfied with CC measurement	Satisfied with Ease of Use
R1	x	x	x	x	x	x	x	x
R2	x	x	x	0	0	0	0	0
R3	0	0	0	0	x	0	0	0
R4	x	x	x	x	0	x	x	0
R5	x	0	0	x	x	0	0	x
R6	x	x	0	x	x	0	0	0
R7	x	x	x	x	x	x	0	0
R8	x	x	x	x	x	x	x	x
R9	x	0	x	0	0	x	0	0
R10	x	x	0	0	0	0	0	x
R11	x	x	x	0	x	x	0	0
R12	x	x	x	x	0	0	0	0
R13	x	x	x	x	x	x	x	x
R14	x	x	x	x	x	x	0	x
R15	x	x	x	0	x	0	0	x
R16	x	x	x	x	0	0	0	x
R17	x	x	0	N/A	x	N/A	N/A	x
R18	x	x	N/A	x	x	0	N/A	x
R19	x	x	x	x	N/A	N/A	N/A	x
R20	x	x	x	N/A	x	0	N/A	x
Count	**19**	**17**	**14**	**12**	**13**	**8**	**4**	**12**

Table 4: Technology Factors

4.1.1 Agility

Agility has been the highest mentioned factor found in the respondents' themes. Most respondents agree that Cloud Computing has increased their agility and ability to deliver services to the public faster. Given the current pandemic the country is found in, the ability to respond to the needs of the public is paramount. "*the current Covid pandemic we needed to build various solutions. Things that would have generally taken us anything between six months and a year we've been able to deliver in two to three months*." R7

A contributing factor to this is that there is no longer a need to procure infrastructure or a requirement to appoint a service provider to supply everything, which can be very time-consuming. Another time-saver is the reduction in time spent preparing the hosting server to get it ready. There is also no wait time for delivery of these services to be available for it to be installed. This was particularly a critical issue when emergencies and vital components were needed to restore services.

> "*way back in the day when I was still building racks, that is the foundation for the operating systems and it'll take you three to four days to build the rack and then then another five days to do the operating system, and then comes patching it and connect the networks and that's a two-week job. Now you can achieve it in half an hour. Like with the Cloud is like you're saving ten days easy*" R8

Another benefit with the reduction of the staging phase is that the organisation can respond faster in providing a proof of concept (POC) without wasting an absorbent amount of time on a concept that might fail. This agility during covid allowed the organisation to respond to urgent developments needed by the public, for example, the EVC system for covid or the health check app. "*Everybody was going around signing into buildings and having to do the fingerprint scans at the turnstiles. We built a solution where they could. We could roll it out to everybody's phones. We did it within a week*" R7.

The adoption of Cloud Computing, specifically in the context of the public sector, had inadvertently received the additional benefit of removing the red tape that was in place for many years in the organisation. The departments now procured additional services by developing a retrospective payment plan which the IT department then reclaims.

> "*So you know, within the public service procurement it is quite a lengthy process. And with us putting a decent Cloud Computing service in place that would allow us to expand on the services quite quickly. Whereas in the olden days where we had a break in service, you know and we had to upgrade service, those things would take about 6 to 8 months before you could realise benefits… So the one biggest benefits I think, or was that agility and you know, for us to ramp up quickly*" R4

Respondents see agility in its post-adoption as the primary factor for continued use after the adoption. This is a significant transition away from its original primary factor of cost. Agility has been highlighted as a benefit of the adoption; however, it was more aimed at the fact that organisations no longer were required to perform capacity planning (Olumide, April, & Van Belle, 2013). In the case of the public sector, this factor has allowed the organisation to overcome historic stumbling blocks and circumvent the previous procurement issues, which prevented the organisation from responding adequately to requirements.

4.1.2 Flexibility

Literature sees flexibility as just one of the benefits of the adoption of the Cloud, allowing an employee to work anywhere, access their data, and work remotely (Xue & Xin, 2016). The Covid pandemic had changed the way how organisations work and operate. This forced organisations to be more flexible due to the fact that their employees would have to either work remotely or work with fewer people in a single area due to social distancing.

> "*Initially costing was the main benefit. But what has transpired when we adopted it was the covid pandemic that came and been the most valuable benefit was the fact that people could work from home or away from the office and access to the information which wasn't there before*" R6

Due to the global pandemic, the organisation changed its view on its need to be flexible. They no longer view flexibility as just a benefit; it has become a requirement to ensure continuity of service. This ability to access information has aided other operational areas by changing and reducing the efforts incurred in carrying out daily tasks historically. Information has been centralised and made accessible when data gathering occurred; this could now be viewed by all and done in real-time and not retrospectively. Thus, providing much-needed accurate data during the covid pandemic in the health departments especially.

> "*we've been on the journey a couple of years now, and because the pandemic has hit us and it is now a requirement, it's not a nice to have and I think that's the important point here. It's not a nice to have, it's a must have*." R1

In a discussion after an interview, it is important to note; it was disclosed that some teams in the organisation were able to work from home before the adoption of the Cloud. It was not widely approved but became more commonly performed out of necessity because employees needed to work from home and isolate themselves. "*Some of these things we could always do, it's not only now, we had remote workspace long ago before Cloud"* R5

Flexibility post-adoption has transitioned from being just a benefit or nice to have in an organisation to a mandatory prerequisite for an organisation to perform its business. The additional benefit other than the ability to work from anywhere in a pandemic is the ability to provide accurate live visibility to the organisation's data. This particularly in the context of the PPE and EVS health systems, was crucial in the COVID-19 pandemic.

4.1.3 Reduction in Staff Reliance

Literature indicates that a decrease in reliance on IT staff is one of the benefits of adopting Cloud Computing. It removes IT administrative tasks to maintain the infrastructure and allows for IT teams to focus on other organisational business goals (Olumide et al., 2013; AWS, 2020; Microsoft, 2020).

The organisation's administrative tasks have reduced with the adoption of the Cloud. This has allowed for resources to focus on more critical tasks and removed tasks that, in some cases, have been inherited by a particular application. "*General maintenance activities reduced, we have had a better guarantee of uptime and securing services is running… and especially after the Eskom saga. We had to run around to replace UPS*" R11.

It also reduced the amount of time IT personnel had to spend to plan for downtimes in the organisation due to updates and the amount of time in a meeting discussing these future updates. *"The upkeep of the servers kept us busy, if you were in the change board meetings, it was just about server updates that was needed. We can finally do what we supposed to do in our jobs*" R12.

Another essential benefit to reduce IT administration is system dashboards and analytics. Performance reports can be compiled much quicker for stakeholders. IT personnel can identify errors and where they reside to troubleshoot and restore service faster.

> *"It's much much easier in terms of checking if the services up than before and obviously getting tons of reporting in terms of looking at hardware, looking at usage, uh, looking at to see if there's any uh, you know any faults on the on your service itself… we use the monitoring tools that have been introduced. You can support the servers in the Cloud is much easier than having to do the same on a physical server itself, so the tools has made it quite easy*" R9

These reports also provide the organisation with a further capability to review its IT operations. These provide essential insights to the IT administrator for service improvement and the current standing around the governance of data in the organisation. Previously, this was done over days or projects to ascertain this data. "*it's a system add onto Azure. You can deploy the system and this thing can just sort of scan and help you get a better understanding of your data governance, and you know with the issues*" R8.

> "*The amount of reporting that we are able to get out of. Cloud. Solutions is far better than what we've ever had on-premise. In actual fact it's opened my eyes to the fact that we needed more security architects to come in and actually assist us in shaping the environment to ensure that, uh, you know, security is heightened, and Tighten"* R7

Even though the Cloud solutions have reduced the amount of IT administration, it has however not removed everything in all cases. IT administration still has some tasks that they still have to do, for example, basic configuration and maintenance. "*They don't implement anything for you. You must still decide what you want to do. Watch policies you need to put in place, etc. Its just like Gmail, you know, like a Gmail for your workloads. You must still configure things in there"* R8.

Post-adoption, staff responsible for the IT administration can now perform better in their jobs and have more time to focus on other work now that Cloud Computing has removed the burden of monthly updates. Due to the system's built-in analytics, the addition of reports and dashboards has also decreased the amount of time on tasks that must still be done, such as troubleshooting or performance monitoring. There is not much emphasis on reporting and dashboards in Cloud literature and the benefits that can be derived to reduce work in an organisation.

4.1.4 Reliability

Literature indicates that the services provisioned via the Cloud are available 24/7 due to its data back mechanism onto which it creates multiple mirror copies giving the organisation business continuity and disaster recovery (Olumide et al., 2013)

The organisation has so far had minimal downtime of its applicational services. It has benefited from not having to repair faulty and degrading hard drives. Restoring data has also become more straightforward and no longer complicated compared to legacy methods. *"It is so easy to restore information or something that in teams is deleted. With services in the Cloud, the turnaround has improved and its efficiency and service delivery because everything is accessible and available immediately and most importantly, not on the land or physical*" R6.

The expected backup services that were envisioned, however, have not panned out as expected in every case. The way this service was described, it was to provide a copy of data saved for it to be recovered. However, due to changes in services over time, some services are now required to have a secondary backup which is an additional expense.

> *"For me, I don't think that the Cloud has been properly studied that we published, scrutinize, and come to a proper solution. We'll there was a lot of debates about things and for security we found out that even though you have everything in the Cloud which you assume is backup 100%, now we must be running a backup over a backup in the Cloud"* R5

In some cases, the backup service required for a large amount of organisational data is not available due to the type and size of the data needed to be ingested. In one case, the shared folder of the organisation was not migrated, leaving it to be left on-premises. "*You know that the organisation has file shares, about 7 terabytes of information. We couldn't put it in the Cloud; that's what Microsoft told us; we asked why but didn't get a proper explanation. So, this is still my baby to take care of* "R12.

There are legacy applications that cannot be migrated to the Cloud due to compatibility issues. This means that the benefits of Cloud are not achieved fully, and legacy issues remain in the organisation. "*most of the legacy applications that are actually run from a national perspective, they potentially can't run on newer technology anyway, so those are the types of things that you know, it's still in the pipeline for moving over to Cloud Computing, so that definitely was not effective for us*" R4.

Post-adoption, the organisation has benefited from the migration of some of its data and systems to the Cloud. This has reassured them that their systems will be up and available with minimum intervention. In some instances, this reassurance has cost more, requiring back-up of back-ups to ensure recovery in case of a problem. The only factor has been that not all systems and data can be put into the Cloud. This means the organisation cannot fully benefit from the solution; however, it has reduced the previous burden on the organisation.

4.1.5 Security

Literature highlights both the pros and cons of security when adopting a Cloud solution. Cloud gives the organisation additional tools to aid in the strengthening of its security posture (Olumide et al., 2013). On the other hand, there is a lack of transparency from the service provider with regard to adequate protection and confidentiality for the organisational data (Ali, 2016).

The adoption of Cloud Computing in the organisation has strengthened their security and given them the tools to be reactive to protentional threats. "*Any security incidents that happened we can easily spin up security solutions which would normally take a year or two years to do over a tender*" R8. Not only this, it has broadened the way it does its security but adds additional measures with the new information provided by using a Cloud solution such as logon locations. "*So we started getting alerts about people logging in from different countries and we had to put policies in place to say, OK, you're going to log in from this places*" R11.

Even though these benefits are gained by the solution, there is still some fear with the adoption. Some of this fear has been reduced due to the fact that service providers have created footprints in South Africa now, which means that data is now residing within the country's borders. *"I always said that the main fear is that of cyber security, you know security is one of the biggest challenges with your data being out there… imagine this type of information falls into the wrong hands? "* R6.

> "*so there was a real concern specifically expressed by the client departments around security, and you know, at that time we didn't have what we have today, with POPI and all of that and there was the concern that when you move to the Cloud you are now giving up your data and you are weakening the security… we alleviated this by waiting for Microsoft to create a footprint is South Africa before moving our data*" R1.

However, this still does not reduce the organisation's concern that they can not precisely confirm where the data is and who possibly might have access to it. "*I still don't know who has access to my mailbox, so that's gonna be a issue, but then again, you look at the end result. You look at what you get out of it. Yes, I have access to my mailbox. I don't have issues*" R11.

Post-adoption, the organisation feels that although these security concerns exist, they have looked at it from a different perspective. The additional security provided by the Cloud has provided a more in-depth view of their own security and has made it possible to strengthen and improve it. It has provided them the tools to react to security threats and tighten their security policies. Thus, this has placed the organisation's security posture in a better position than what it was previously.

4.1.6 Performance

Literature indicated that performance is increased in the Cloud due to working on the latest hardware and reducing latency for applications. (Olumide et al., 2013). Only 8 of the respondents mentioned this factor when adopting Cloud Computing. As technology and software develop, the organisation's hardware and software need to be updated in order to run these systems.

> *"If we didn't move into the Cloud we would be struggling right now because our physical infrastructure in the provinces constantly needs updating. The shifting to the Cloud has alleviated that in so many ways 'cause you don't have to go and change all that infrastructure…. We can leverage some of the new services that we got because they could play with these things in test environments*" R7

Performance, however, was not a primary factor for adopting Cloud Computing in the pre-adoption phase. It appears to be seen as a by-product of the adoption of Cloud. *"it wasn't just to remain cutting edge, it wasn't about that at all. It was to drive efficiencies to be more responsive as a unit"* R1

Post-adoption, performance has increased due to the replacement of failing infrastructure and the ability to run newer systems. It has not been seen as a significant factor; however, it is required for Cloud Computing to be as responsive as required for the organisation's needs.

4.1.7 Measuring Cloud Benefits

Literature indicates that organisations do not know how to measure some of the benefits they might have received with Cloud Computing, especially intangible ones. Measurement of benefits is further made difficult as there are no standard metrics used to measure the success of these factors. There are varied and diverse opinions on what constitutes the realisation of the benefit (Johnston et al., 2016).

This appears to be consistent with regard to the implementation with the organisation. Not all services and benefits have been defined to confirm if the solution has benefited the organisation, but rather seen as "successful" if the solution has been incorporated in its technology catalog. "*We didn't do it in that*

way because it was a strategy document, so I do acknowledge that that's a limitation on our side, but I think the business benefits or clearly articulated in this strategy." R1. The organisation has now retrospectively seen the need for this measurement to illustrate to their stakeholders all the benefits that the organisation has to validate the adoption to them in some areas. "*It is something that we need to do. I think we've identified that you need to measure the success of it and what the metrics are for measuring that particular success"* R13.

The benefits that the organisation did choose to measure was only tangible as it was part of the primary strategy of moving to the Cloud initially. *"we did initially identify when we move from on-prem into the Cloud is the response times for users as a measure and then secondly cost or cost reduction"* R13

Although many of the benefits of Cloud Computing, both tangible and intangible, were not measured in the organisation officially, many have identified that the benefits are experienced. The most common benefit on an employee level mentioned was the reduced time to procure infrastructure and time to manage the on-prem environment. The question that remains is to identify the degree and in what area has the benefit been seen in some cases as some responses are conflicting in reports of benefits.

4.1.8 Ease of Use

Some respondents assumed that the adoption of Cloud Computing would have some challenges but be easily manageable. "*Microsoft consultants sort of promoted the package, made it sounds so easy to adopt, and a walk in the park. Considering that, we didn't expect any major sort of difficulties to continue with the services that we render*" R11

Managers in other spaces with services such as applications to be migrated had a much more conservative opinion of the challenges they faced in migrating to the Cloud. "*I don't think that we thought that it given that the technology at the time was quite new*" R7. Some of the services have been so complicated compared to what was expected that the service had not been migrated to the Cloud.

> *"What we thought were going to get is not what we got. It didn't work that way, I thought it was easy. It's not an easy solution because we still busy. After a year of adopting the Cloud, we still busy in the process of moving to the Cloud because you haven't crossed all our T's and dotted our I's"* R5

It appears that the ease of use of the Cloud and the transition to move the organisation's service has different levels of difficulty depending on the service. In most cases, it has been an easy transition, but some services that were expected to be seen as easy, with the consult of the vendor, still have had issues in its transition.

4.2 Organisational Factors

Under the major theme of organisational factors, a total of 4 themes was identified. The most significant of these themes under this section was "cost of computing," as shown below in Table 5. This breakdown also aims to answer the sub-questions and try to identify how the organisation has changed and benefited from the adoption

Organisation	Satisfied with Cost of CC	Satisfied with Organisational Readiness	Satisfied with Management Support	Satisfied with Human Resources
R1	0	x	x	x
R2	0	x	0	0
R3	x	x	0	0
R4	0	x	x	x
R5	0	0	x	0
R6	x	x	x	0
R7	0	x	x	x
R8	x	x	0	x
R9	0	x	0	0
R10	x	0	x	0
R11	0	0	0	0
R12	x	0	0	x
R13	0	x	x	x
R14	0	x	x	0
R15	0	0	x	x
R16	N/A	0	x	N/A
R17	N/A	0	x	x
R18	N/A	N/A	x	N/A
R19	N/A	0	x	N/A
R20	N/A	N/A	0	0
Count	**5**	**10**	**13**	**8**

Table 5: Organisational Factors

4.2.1 Cost of Cloud Computing

Literature indicated that organisations' main driver for adopting Cloud Computing was the perceived cost-saving (Smith, 2020). The general agreement with respondents is that there is a cost-saving with its implementation in some areas from a departmental view. The cost of the Cloud can be split into the initial implementation cost, running cost, and cost-saving initiatives.

The initial cost to the organisation was to ensure that they would be ready to operate in a Cloud environment. The network infrastructure had to be upgraded across the environment to ensure appropriate connectivity and speeds to connect to the Cloud services. Applications had to be modified and configured to be able to migrate into the Cloud.

Some other cost-saving came from the centralisation of application from the multiple single instances being run in the environment. Running cost was reduced by the removal of on-prem infrastructure. This also removes the need to upgrade or replace old degrading equipment. A further benefit is that the spaces needed for the storage of the equipment are also no longer needed and reducing server room running costs such as electricity, aircon, and maintenance. "*aging architecture had become significant in costing for upkeep and the fact that we required additional staff"* R4.

> *"the current infrastructure and networking was degrading overtime. So servers were out of warranty and then they had this massive bulls coming up and government is cutting their budgets because of you know covered and all these other pressures. So we need to spend less or will be more efficient without money so that the Cloud value proposition was you can come into the Cloud"* R8

However, the cost-saving from a holistic view of its implementation and running costs has not been seen. Cloud costs to participants are currently at an equivalent in running costs. The cost saving is predicted in the next five years.. *"so it's probably still evenly balanced, and with that the Microsoft argument is it's going to even out after five years. You're not going to immediately see the value, is the same on the Oracle side" R1.*

In some cases, there are even times where the Cloud service has cost more than the on-prem service that they would have provisioned due to configurations made in its implementation. *"I think that we are novices in the Cloud space and as we gain more experience will be able to optimize it much better"* R7. Interviewee R15 stated that their expenditure had increased by a reported 300%.

> "*think it is maybe not as much or as we expected, but for me that's most probably one of the disadvantages of the Cloud environment, is that because it's consumed by individuals, it can get out of hand and the cost start to skyrocket quite quickly and significantly, if you don't have a way of managing that" R13*

The costing of Cloud services has also changed over time from its initial adoption with some of its services. "*Microsoft realised that if they continue down this digital trajectory where revenue is concerned, it would not grow and when they started to re-think Cloud, they actually realise this is a way to increase their revenue. And that is coming at the cost for us*" R1.

Another issue was the configuration of the Cloud solution. Interviewee R15 indicated that because the tenant was initially misconfigured, a lot of time and money went into correcting these configurations to ensure there was proper connectivity. The main contributor to this issue was that the person that did the configuration did not consult others and worked in isolation. Thus only when an issue was picked up was additional skilled resources brought in to assist.

This change of how the costing is done is not the only variable of change that must be considered. The cost of these services is billed in Dollars and is subjected to the fluctuation of the exchange rates. *"we submitted invoices for finance to pay when they charged it at 13, right? So was 13 to the dollar, so then there were some delays then eventually made the payments it was 15. So that's almost a 20% bump on the on the price in rands"* R8.

This way of paying for services is a significant shift from how it was previously done as the cost are more fixed and predictable for more extended periods. *"You do a costing for a contract for maybe three years. OK, we decide 10% increases rights which doesn't change dynamically"* R8. This in the future can become a big problem for the current savings being projected due to the unknown changes. "*It's an unmanaged risk. You can't actually manage it… It's a big unknown also, thankfully we haven't experienced anything crazy. But you know what's unknown could be bad for you, you know?"* R8.

> "*we might have underestimated a little in terms of what we had and had to move in the Cloud. Maybe three reason, the organic growth in that environment that we most probably did not consider enough and thirdly is the additional requirements especially driven by COVID-19*". R11

Given this uncertainty of cost and the possibility of it no longer being the driver, the Cloud will continue to be used due to the other benefits that it is providing. Instead of removing the innovation due to shrinking budgets, the organisation would instead reduce their Cloud footprint. *"I think if we did reach that point and I doubt that we will because it's not an expensive solution, then it would rather mean scaling down rather than eradicating*" R1.

The literature review equated the unpredicted or hidden cost associated with poorly planned Cloud adoption strategies or the insufficient understanding of IT expenditure (Gupta et al., 2016). It appears that these are not the only factors that can create unexpected costs. The original adoption strategies have developed as the vendor's provisioning of services has changed. The requirement to optimise Cloud services before its provisioned is paramount to contain costs that might not have been initially expected. Lastly, the time of payment to the vendor can either increase or decrease due to the exchange rates, which cannot be planned. Literature also views cost as the main driver for Cloud Computing adoption, but it is not the main reason for continued use after the adoption. As stated by the respondent, even if the cost is the same, the other benefits are sufficient to continue using the innovation.

4.2.2 Organisational Readiness

An essential factor to consider in an organisation is its readiness to adopt new innovations (Rosli et al., 2012). This is not largely reported on in the literature; however, it is a major component for the successful implementation of Cloud Computing adoption.

The organisation identified legacy applications and the need to improve the connectivity of its network to get the most value from the Cloud. One of the measures put in place was to create a strategic plan to upgrade legacy applications, migrate them to the Cloud and phase out others that cannot be upgraded. This meant that the organisation knew that they would be saddled with specific applications on-prem until its replaced.

> *"we actually found that we didn't actually have to do too much work to prepare the application to move it into a Cloud environment. The decision that we took as an organisation… we're not going to move junk across, so we made a decision to optimize 1st and then move across, and I think that stood us in good stead"* R1

The organisation's second phase of the plan was to start projects to renew their network infrastructure to ensure better broadband and gigabit speeds in the environment. Another upgrade was to the organisation breakout to the Cloud services, ensuring that they have an express route connecting to the vendor's services via SITA. *"there were serious broadband challenges which prevented that, and also the engagement between "us" and I would say, the state information technology agency, in terms of those security boundaries that needed to be set up.*" R3.

Due to all these things being in place, the time came to expand on the Cloud service rapidly because of the COVID-19 pandemic; they were able to do so relatively easy. *"because of the pandemic it was quicker to realise because even though we started this journey two years ago and by the time the pandemic hit we were able to then scale it. Because you know we already had what was needed in place"* R1.

An issue highlighted by interviewee R15 is that the employees in the organisation were not ready for overnight changes. These changes also came as a surprise to the organisation as the service provider did not inform the organisation appropriately. The vendor would implement a new add-on application to the Cloud solution without change management. This caused a knock-on effect and caused an increase in support calls, which put a strain on the IT service desk. This resulted in additional consultants being requested from the supporting vendor to manged the high volume of calls. The organisation's SLA with the Cloud vendor was later changed to incorporate better change management to prevent future incidents.

The pre-adoption preparation done in the organisation can be seen as paramount to the success of Cloud implementation. If services are not identified beforehand, which can or cannot be migrated into the client, it can become a fruitless exercise in some other organisation. The organisation's infrastructure readiness to be able to handle a new method of work should not be underestimated. Considering the organisation's need to expand on their Cloud services due to the pandemic, if this upgrade were not

completed prior, the expansion would have faltered when rapidly increasing its services so quickly. This could have resulted in the organisation seeing this as a poor Cloud experience.

4.2.3 Management Support

Management support is a critical component for the adoption of any new innovation in an organisation. Management support ensures the appropriate allocation of capital investment, skilled resources and incorporates the innovation in the organisation's procedures (Oliveira & Martins, 2011).

There was clear support of the innovation and the adoption. Discussions around the solution already started taking place ten years ago, with initial discussions with the departments to adopt taken five years later, and adoption shortly after that, expanding on it continuously. As mentioned earlier, there was also a readiness phase to ensure that the organisation could adopt the technology and ensure the organisation can keep with the latest technology. "*as government we set innovation trends, we not followers but we do work with Gartner as well and I think ten years back already, that was introduced in a message that we should come up with a strategy for Cloud Computing going forward, and I think it worked out well*" R6.

Management ensured that the applicable skills were provided implement the technology to ensure a seamless transition in operational support. This was done by ensuring that there was a vendor in place to provide the service, external contractors or that there is a transfer of skills during implementation. *"We have very few or little staff, but we have a large component of contractors, and these contractors come out of the industry with knowledge of working within this space. So, we leverage that with our internal capabilities in order to adopt the Cloud. And that, I think, is what has really speared, this initiative to success"* R7.

The organisation's management's appetite to adopt was good due to the benefits of the Cloud being a driver for its adoption. Management observing this ensured that there were drives to communicate and promote the adoption throughout the organisation. Management also ensured that there was sufficient capital to ready the organisation to adopt and get the skilled resources to implement the solution.

4.2.4 Human Resources

Employees of the organisation can influence the success of the adoption of an innovation. If they reject the innovation due to personal reasons, the adoption can fail due to their own perspective and beliefs and not on the merits of using the solution. Pre-adoption, the employees had fears of adopting due to the perception that they might lose their jobs.

> *"Older folk I think just more from a change management perspective. It's been tough to try and transition from what you were just doing a daily basis. Now all of all of a sudden, it's taken away because the Cloud just does it for you… some were thinking am I becoming obsolete, and I think within the application space we also had some difficulty there*" R7

This however was not the case. Employees had more tasks and work to do. They were able to now focus on their core functions of their jobs. In some cases, they could spend more time making improvements that they could never get to before. *"I can finally do my job, it's only taken 20 years to get to a point where I can do what I'm actually employed to do"* R12. *"You actually have more work now than you've ever had before. You need more people now"* R8.

Post-adoption perceptions changed; employees found that they could accomplish much more work due to the fact that additional tasks were removed from them. In some cases where tasks were not removed, it was improved and made more effective. This allowed management to provide additional work to them that was perhaps never gotten to due to the fact they were always kept busy with IT administrative tasks.

4.3 Environmental Factors

Under the major theme of Environmental factors, a total of 3 themes was identified. The most significant of these themes under this section was regulatory factors, as shown in Table 6. This breakdown also aims to answer the sub-questions and attempt to identify how the organisation has changed and benefited from the adoption from an environmental point of view.

Environment	Satisfied with Regulatory Factors	Satisfied with Internet Dependency	Satisfied with Pressure to Deliver services
R1	x	x	x
R2	x	x	0
R3	x	x	x
R4	x	x	x
R5	x	x	0
R6	x	0	0
R7	x	x	x
R8	x	0	0
R9	x	x	x
R10	x	x	x
R11	x	0	x
R12	x	0	x
R13	0	0	x
R14	x	x	x
R15	x	0	x
R16	x	0	x
R17	x	0	x
R18	N/A	0	x
R19	N/A	x	x
R20	N/A	N/A	x
Count	**16**	**10**	**16**

Table 6: Environmental Factors

4.3.1 Regulatory Factors

As identified in the literature review, public organisations are governed by the SITA Act in how their IT service is rendered (Government, 1998). Additionally, other regulations can hinder the utilisation of Cloud Computing and its expansion of use in the organisation.

The organisation experienced many delays in procurement of services and implementation in technology pre-adoption due to conforming to the SITA Act. SITA has had to adapt to making Cloud

Computing available to the public sector and has tried to develop their services to act as the Cloud provider for the Government, enabling the consumption of Cloud services. Some of these procurement issues have thus been streamlined; however, SITA still restricts the utilisation of some Cloud services to remain compliant to SA standards set out. One such restriction is only to consume services within the borders of South Africa. This restriction limits the organisation in some instances, as there is a possible delay to utilise a service if it has not been provisioned yet in the southern region. "*very specific advance services are sometimes only available in Europe or America or Asia or whatever, and they're not generally available in South Africa, but they are available to consume from South Africa*" R8.

> "*we were also told that you're not allowed to shoot your data out of our boundaries of certain countries and at the boundaries of South Africa and now with her peer to peer app will not 100% sure how that data is being shared and where the data is being shared and ways that we stored. So all those things must be taken into account and looked at*" R5

There are further restrictions to the utilisation and the configuration of the Cloud. The organisation cannot connect different tenants such as public and private Clouds. This restriction has resulted in multiple Cloud instances being used to enable public access to some of their applications. "*We're not allowed to do that, but, uh, Microsoft has implemented guardrails. So we can stay compliant with SITA as regulations"* R8.

Another issue is with the redundancy of the internet breakout of the organisation. The organisation could not procure a backup breakout to the internet, which is vital for the organisation to remain in operation if SITA's primary line becomes faulty. This creates a single point of failure for their services and no alternative to remaining operational. "*So when we have issues with SITA or that express provider on-premise, we don't have connection to Azure you know what I mean. So like I mentioned before, there is a risk if you extend your Cloud from on-premise, and there's a break in service over there*" R8.

Due to these restrictions, many feel that SITA hinders them from being able to provide services to the citizen. "*Sita was envisioned to be the connector of government, but it's more like the disconnector of government now. It's actually a irony*" R8.

In July of 2021, another legislation came into effect around the protection of personal information (POPI). This policy governs the distribution and the storage of some types of information. This further restricts the way the organisation utilises the Cloud, as further data may no longer be permitted to be migrated into the solution. However, this is still being implemented and how it affects the service is to be confirmed.

> *"So the implementation of POPI was a big factor and being ready to implement those regulations is a concern… I think we're not there yet. We still need to look at all we implementing with the regulation in relation to POPI correctly. Remember, it only came into effect in July. So Cloud by design would have to adhere to those regulations the way that they will see it, and I'm not sure because we brought in the regulation post us moving to the Cloud so that is also concerned*" R1

Another consideration is the policies that public servants are contracted to, which dictate when and how they render their services. The current policy states that public servants must work 40 hours a week on-premise. "*some rule they have to go twice a week at least*" R3. This is due to the Department of Public Service and Administration viewing public servants as being paid for their time and not a specific task. This discrepancy has been overlooked by management due to the COVID-19 pandemic.

The regulations that currently govern the implementation of Cloud in the organisation could seriously impact its future implementation and expansion. The restriction of the organisation to be solely dependent on one entity for its Cloud access is a significant risk, and it is currently still a big concern for them. The governance of data and services could also force the organisation never to be able to fully implement Cloud Computing, as on-prem servers would have to cater for some of its data and services which cannot be accessed or stored outside of the South African boards

4.3.2 Internet Dependency

Literature indicated that for an organisation to take full advantage of the Cloud model, its employees and premises must always have an active internet connection. This requirement is a major stumbling block in a developing country such as South Africa due to its poor quality or availability of connectivity in certain areas (Verma, 2014). "*we have drops once or twice a day*" R18.

This requirement has been found to be an issue within the organisation, as it services a large area where there are rural areas with inadequate infrastructure. This limits the organisation's ability to enable the entire organisation to benefit from the Cloud solution, hindering the further adoption and unifying the solution across the platform.

> "*when you look at the rural sites and then you have much bigger concerns because there is not high availability of Internet. So those are the challenges we have now. So what kind of services do you give them and in those instances that's where Cloud service is actually not that much of benefit because then you have to think about something on-prem because of Internet services and I'm like that's not linked to saying that Cloud services is now, well satisfactory"* R9

Due to this, there is also a concern to move all the services into the Cloud without having an on-premise solution in case there is a problem with the organisation break-out to the internet. *"I think to a degree we will always run a hybrid solution. I think all companies must run a hybrid solution"* R4.

Post-adoption, there have not been any outages as yet, as mentioned in the above section on reliability. However, the concern over not having a backup plan for the organisation has kept the organisation from moving into the Cloud totally. This means the organisation has not benefited fully from the Cloud solution and has not removed the additional overhead that comes with having an on-prem hybrid solution.

4.3.3 Pressure to Deliver Services

In the public sector, there is no competition as such to compete for a percentage of a market share; however, there is pressure from its citizens to deliver on services. Organisations outside of the public sector perceive Cloud Computing as a solution that can provide a competitive edge for the organisation as they operate in a competitive environment to outperform their competitors (Oliveira et al., 2014).

> *"We within government, we tend to not look at costs, because it's not a profit and loss organisation. It is based on citizens. So we look at cost effectiveness obviously, we look at fit for purpose obviously, and both of them must meet hand in hand. Sometimes fit for purpose might come at additional cost and within the government space, we need to look at the needs of the citizen that is out there*" R10

Given the need to provide services faster to the public, the organisation continually improves itself. Adoption of Cloud was seen as essential to be able to do this in their next phase of development of service offerings. This was especially the case during covid, as the public had to isolate. "*in order to be efficient and to deliver the service to the citizen out there, we need to adapt and adopt*" R10. "*our agility and ability to respond to citizen needs and or the needs of the organisation. That's improved significantly. Examples of that is during the current Covid pandemic we needed to build various solutions*" R7.

The availability of services and their delivery to citizens is fundamental to the organisation. Post-adoption, the Cloud has made it possible to provide these services efficiently for citizens to access them remotely. During the pandemic and in the future, it will give the organisation a better reputation and ability to service their citizens efficiently.

5. Discussion

The following section reviews the findings from the research in correlation to the literature review. The researcher intends to identify if the research findings are supported by current literature. Identify differences and gaps in literature; and discuss why these differences and gaps exist. The discussion will be broken up into the research framework's identified themes. These themes are further grouped to answer the research sub-questions.

5.1 Research Sub-Question 1

- To what extent are perceived Cloud Computing pre-adoption benefits actualised in technology post-adoption?

5.1.1 Agility

The findings indicated that most participants agreed that agility is a critical benefit that the organisation received in the post-adoption of Cloud Computing. In the past two years, there has been an increase in pressure for the IT department to quickly deploy new services in response to ever-changing environmental conditions such as COVID-19. The use of the Cloud in the organisation has decreased a typical service deployment phase from a year to a few months.

Adoption of the Cloud has further removed procurement stumbling blocks that have been existing in the public sector for many years. Infrastructure that was previously needed to run a POC or new service is no longer needed, thus removing the long delays in procurement and time spent configuring hardware and operating systems.

The findings in this research are consistent with the literature. The adoption of Cloud Computing removes the requirement for organisations to perform capacity planning (Olumide, April, & Van Belle, 2013). This allows organisations to rapidly deploy new services and remove the need to procure infrastructure (Xue & Xin, 2016). As the government's Cloud strategy indicated, the adoption of Cloud would reduce procurement processes and improve service delivery (Rajgopaul, 2018). In prior surveys, agility was rated as a high valued benefit and second overall (Smith, 2020).

Compared to the existing literature, the difference in this study's findings is that the organisation currently views agility as the primary benefit. This increase in the perceived value of this benefit can be attributed to Cloud Computing removing legacy procurement issues found primarily in the public sector and the fact that the government had to respond rapidly to the COVID-19 pandemic.

Consideration to the agility benefit being received is that the Cloud services being delivered to the organisation are not provisioned through the future envision government Cloud (Rajgopaul, 2018). As one participant indicated, once the organisation moves to SITA services again, there is a possibility that the delay in services will return. Secondly, once the COVID-19 pandemic has ended, the need for the organisation to be agile could decrease, lowering the perceived value of the benefit.

5.1.2 Flexibility

The findings indicated that most participants agree that they have more flexibility post-adoption of Cloud Computing. The organisation migrated more of its business application and process flows to work through a Cloud service. This was to ensure that employees would have access to their work in response to COVID-19, as mandatory isolation and social distancing were implemented.

The migration has also improved some business processes in the organisation, allowing employees to perform work that could only be performed at a specific location previously, to be performed anywhere. This reduced delays in capturing information and provided much-needed live and up-to-date information for tracking. It also reduced general efforts incurred in carrying out daily tasks.

The organisation had the capability to work remotely prior to the Cloud adoption but was restricted to a select few. However, the organisation changed its stance on this and no longer thought of remote work as a nice to have but a necessity. Participants are hopeful that remote work will continue post-pandemic and that this benefit will continue in the organisation.

The findings in this research are consistent with the literature. The adoption of Cloud Computing allowed the organisation to conduct its business anywhere and access organisational data (Xue & Xin, 2016). The difference in the findings of this study, as compared to the existing literature, is that the organisation currently views flexibility as a higher priority. Flexibility appears to be the third most valued benefit; however, prior adoption surveys do not list flexibly in the top 7 most wanted benefits (Smith, 2020).

Consideration of the flexibility benefit being allowed currently is primarily due to the COVID – 19 measures in place. The reason for the limited amount of remote work that took place previously was due to organisational policy that disallows any public servant to perform their work from any place other than their offices. As stated by the participants, if this policy is not officially changed, remote work will not be allowed in the future post the pandemic. Another consideration is that some participants associated remote work as a benefit produced by Cloud Computing; however, the benefit already existed in the organisation. This could increase the perceived value of Cloud Computing as it appears to create a benefit when one is already existing, thus creating a false association to this benefit. It can then be argued that this benefit was not newly received but rather more widely adopted with Cloud Computing.

5.1.3 Reduction on Staff Reliance

The findings indicated that the organisation had reduced the reliance on IT staff. Maintenance and other mundane tasks no longer need to be performed by engineers. Some of these tasks could take days to complete, which now is done without intervention. Reporting on the infrastructure has also been made it easier to view the entire organisation's health status.

Although tasks have been reduced, they have not been replaced entirely, and some basic configuration remains the engineer's responsibility. The findings in this research are consistent with the literature. The implementation of the Cloud allows employees to focus on other organisational business goals (Olumide et al., 2013; AWS, 2020; Microsoft, 2020). This also reduces the amount of staff required as

employees have more free time. This is particularly important due to the lack of skilled resources in the public sector (DPRU, 2007)

5.1.4 Reliability

The findings indicated that participants are not in consensus regarding whether they have received the reliability benefit post-adoption, as envisaged in the pre-adoption phase of Cloud Computing. Most participants agree that there has been a lower rate of downtime in the organisation and less intervention to recover deleted or corrupted data.

However, the vendors' ability to fully cover the organisational data was over-promised. One participant indicated that post-adoption, they were informed that in order to be fully covered, an additional backup would be required at an additional charge, as the reliability of the backup could not be guaranteed. Due to what appears to be size-related, some organisational data could not be ingested into the Cloud. This has resulted in onsite infrastructure being retained and the organisation unable to remove some risks and administrative tasks as anticipated.

The findings in this research are partially consistent with the literature. The organisation did receive the ability to have a higher uptime rate, increase business continuity, and recover in case of a disaster (Olumide, April & Van Belle, 2013; AWS, 2020; Microsoft, 2020). When the recoveries were required, the process to recover the data back was quick due to the multiple mirror copies (Ali, 2016). The difference in the findings of this study, as compared to the existing literature, is that reliability is viewed as part and parcel of the utilisation of Cloud Computing and not as an add-on benefit to be purchased separately. The limitation on the size of data being ingested is not mentioned, nor that certain types of data cannot be stored or ingested into the Cloud. Given the difference between the perceived pre-adoption and post-adoption actualised benefit, it can be argued that the benefit has only been partially received.

Consideration to the reliability not fully been achieved is due to changing service offerings from Cloud providers. Changes made to the service by the Cloud provider appear in some cases to negatively impact the Cloud consumer. These changes have been noted in literature by Meinardi and Clayton (2020), which created similar cost increases in other use cases.

5.1.5 Security

The findings indicated that participants mostly agree that their security has benefited from the adoption of Cloud Computing. Their security posture has strengthened and has given the organisation the tools it never possessed previously. Proactive support was improved with the additional alerts and reports that are native to Cloud security solutions. Engineers could more quickly respond to incidents and provision additional security solutions in a much shorter period, which was not possible prior.

There is some trepidation by some participants that they do not know where their data is located. This is further complicated taking government policy into account that requires citizen data to remain in the South African borders. This concern was alleviated somewhat when Cloud service providers opened a dedicated data center in South Africa. A more significant concern is possible cyber security incidents that expose citizen data

The findings in this research are consistent with the literature. Greater oversight of the organisation's security was possible by enabling security controls and solutions to respond to security incidents (Olumide et al., 2013; AWS, 2020; Microsoft, 2020). The trepidation felt by the participants is attributed to the lack of transparency by the Cloud providers on the exact whereabouts of organismal data (Ali, 2016). Similar to these participants, other studies indicated that security remains a concern; however, it is no longer its primary concern.

5.1.6 Performance

The findings indicated that most participants agreed that the organisation received the performance benefit post-adoption of Cloud Computing. The organisation's focus was less on receiving the latest technology but the removal of the need to replace failing infrastructure continually. The participants see the benefit of constantly having the latest technology as more of a by-product of not managing the infrastructure.

The findings in this research are consistent with the literature. The organisation is equipped with the latest technology and applies its new service to the infrastructure to have the best possible economies of scale (Olumide et al., 2013; AWS, 2020; Microsoft, 2020).

5.1.7 Ease of Use

The findings indicated no consensus between participants on the ease of use when adopting Cloud Computing. Some found the use of the Cloud uncomplicated and straightforward, while others found that the Cloud had caused more issues than what was perceived. This has resulted in some lengthy Cloud adoptions phases for some services. The findings in this research are partially consistent with the literature, Olumide (2018) views the adoption of service into the Cloud to be relatively easy. A consideration to why the adoption in certain areas is problematic could be the lack of skilled workers found in the public sector (DPRU, 2007). Another factor could be the vendor over-promising the delivery and ease of use, making blanket statements that did not cover specific systems.

5.2 Research Sub-Question 2

- To what extent are perceived Cloud Computing pre-adoption benefits actualised in the organisation post-adoption?

5.2.1 Cost of Cloud Computing

The findings indicated no consensus between participants on the benefit of cost reduction when adopting Cloud Computing. A few participants have found that there has been a cost-saving in some areas. However, these same participants also stated that they understood that there would be a considerable upfront cost and that the savings would be only seen in three to five years. When referring to the cost-saving, participants mainly referred to infrastructure that no longer needed to be purchased. Another cost-saving benefit came from centralising multiple instances of applications across departments.

Other participants indicated that costs had increased significantly, and as much as 300% in some areas. This has been attributed to poorly implemented and managed Cloud configurations and an underestimated growth in operational Cloud usage across the organisation. The change in Cloud service offerings has impacted the cost as the solution no longer operated as first envisaged. Lastly, Cloud costs fluctuate due to the exchange rate, making the cost of Cloud sometimes unpredictable. Surprisingly, all participants agreed that they would continue to use and implement Cloud regardless of whether they received their primary benefit of cost reduction. It was stated that the continued use is due to the overall benefits of Cloud utilisation in the organisation.

The findings in this research are mostly consistent with the literature. The organisation was able to remove some costs in the configuration and maintenance of onsite data centers, utility costs, and employment of some technical experts (Olumide, April, & Van Belle, 2013; AWS, 2020; Microsoft, 2020). This was a primary focus due to pressure from austerity policies within the government to curb unnecessary spending and reduce (Sibeko, 2019). Poorly configured or provisioned Cloud tenants have also been cited as a reason for organisations incurring unnecessary costs. This has been attributed to IT managers not understanding the Cloud and the selection of optimal Cloud configuration (Meinardi & Clayton, 2020). The difference in the findings of this study, as compared to the existing literature, is that countries outside of America have fluctuating costs due to exchange rates. Thus making costs for the organisation more complicated and thus can cause musculation's on continuous and future spending. Kim, Y and Crowston (2011) state that continued use of an innovation is attributed to the satisfaction of received benefits. The coverage of literature in this research scenario, where an organisation has not received its primary benefit, has had the opposite effect and caused a 300% increase in expenditure.

The accumulative benefits could be seen as sufficient to overlook this increased cost for the organisation to remain operational. However, due to the austerity pressure, this concession might not be sustainable over time. Consideration to the continued use, although there has been this cost increase, can be given to the fact that the organisation, out of necessity, has to continue Cloud utilisation due to the current COVID-19 pandemic. Furthermore, some of these examples would not have cost the organisation more money before Cloud, as the infrastructure was managed internally and paid up. Using Cloud no longer leaves room for error or previously acceptable configurations; these now can cost the organisation severely.

5.2.2 Technology Readiness

The findings indicated that the organisation took into account factors that should be addressed or put into place before adoption to ensure the organisation's readiness for Cloud Computing. Legacy applications were identified that could not be ingested, and a decision was made to maintain these on-premises. The organisation had a Cloud strategy in place for new applications, which was a Cloud-first implementation. Broadband connectivity across the organisation was upgraded due to the solution's dependency on internet connectivity. With these measures put into place prior, once the pandemic started, the organisation more easily ramped up the expansion of its Cloud services.

However, change management in the organisation is an issue with the adoption of Cloud Computing. Changes and updates to the service provider's platform were released to the user base without consultation with the organisation. This caused its user base to contact the IT department to enquire

what was happening to their application. The organisation had to engage with the service provider to stop changes from being deployed without adequate notification.

The findings in this research are primarily consistent with the literature. Ensuring that the pre-work has been performed to ensure the technology has been upgraded from its failing infrastructure, the organisation was able to adopt Cloud easier (Alhammadi, Stanier & Eardley, 2015). The difference in this study's findings, compared to existing literature, is how the changes the Cloud service providers impact Cloud consumers. Cloud is known for its quick deployments. However, changes to the solution without buy-in from the Cloud consumer can cause issues in the future. This also demonstrates that with Cloud, the organisation does lose some of the control of its systems in the process.

5.2.3 Management Support

The findings indicated that the innovation had the full support of its implementation. Management ensured that there was sufficient support to start the initial implementation, providing finance, resources, and a large component of skilled contractors. The organisation perceives itself as early adopters and leaders in the industry when it comes to innovation; thus, management was willing to support these innovations.

The findings in this research are consistent with the literature. The support of the organisation positively affected the adoption of Cloud Computing. This ensured that there was adequate support and resources to ensure the successful implementation of the innovation. (Oliveira et al., 2014). Management supported Cloud so much that implementation started ten years prior to receiving an official Cloud policy in 2021 (DCDT, 2021).

5.2.4 Human Resources

The findings indicated some initial resistance from employees regarding the adoption of Cloud Computing. Some felt that their jobs were in jeopardy as task usually performed by an individual was now automatically performed by Cloud. Employees, in some cases, felt that they had become obsolete in the organisation. However, the employee later realised that removing some of these tasks allows them to concentrate on other tasks that they could not get to before. In some cases, the employees had even more work than before and felt more help was needed.

The findings in this research are consistent with the literature. The implementation of Cloud Computing did cause some staff to become disgruntled in their work. This created an atmosphere of fear that they possibly could lose their jobs (Olumide, 2014). It is important to note that most of the Cloud services have been outsourced in the organisation. Knowledge of Cloud and its utilisation is limited within its own staff. Only key staff is engaged with updates and developments to Cloud in the organisation. This was made clear when identifying participants to assist and staff declining due to lack of knowledge of its implementation.

5.3 Research Sub-Question 3

- To what extent are perceived Cloud Computing pre-adoption benefits actualised in the environment post-adoption?

5.3.1 Regulatory Factors

The findings indicated that the current regulatory factors are a concern for participants. The SITA act currently restricts the organisation from expanding the Cloud service without conforming to SITA's standard. This restricts the organisation from adopting some services provisioned outside of South Africa. The organisation cannot join different instances, resulting in the organisation creating another Cloud instance to allow its citizens to interact with their services.

The organisation break-out to the internet is also restricted to run through SITA. This does not allow the organisation to have redundancy if SITA goes offline. Given the need for Cloud to connect to the internet, participants are highly concerned about this as SITA is known for its poor service delivery and procurement processes. The introduction of the POPI Act could have an impact on the future of Cloud Computing in the organisation. As this Act has only been in effect from July 2021, participants are unsure of its possible effect on their service. The current use of the flexibly benefit does not conform to public organisations' policies. The overarching Department of Public Service and Administration contracts public servants for their time to be available to citizens; thus, working remotely lessens the contact with its citizens.

The findings in this research are mostly consistent with the literature. SITA has been criticised for its poor service delivery and constant issues. Thus, there is not much trust that there will be business continuity. The POPI Act has been acknowledged in the literature that it will govern organisational data, however as the implementation is recent, its implications have not been widely studied (Microsoft, 2017). The difference in the findings of this study, as compared to existing literature, does not indicate that alternate redundancy can be utilised in public organisations, nor that Cloud services not provisioned in South Africa cannot be utilised. The Department of Public Service and Administration contracts restriction on remote work has not been considered in previous studies. Consideration can be given that the current COVID-19 regulations supersede these, allowing employees to work remotely. However, this policy would need to be reviewed post-pandemic to retain the Cloud benefit.

5.3.2 Internet Dependency

The findings indicated that the internet dependency of Cloud Computing in South Africa, specifically in the context of this public organisation, is problematic. Remote locations in rural areas are unable to utilise Cloud solutions as there is no internet break-out in the area. This has forced the organisation to retain on-prem solutions for these areas to remain functional. Due to this and the trepidation of losing connectivity to SITA, the organisation has decided to remain a hybrid Cloud solution into the future as an on-prem footprint ensures some business continuity.

The findings in this research are consistent with the literature. The poor infrastructure in South Africa is a great hindrance to expanding Cloud Computing in organisations. This has caused reluctance in the organisation to fully commit to a Cloud solution only (Verma, 2014). Consideration should be given that an additional reluctance in the context of the public sector to move from hybrid to full Cloud is the SITA policy not allowing an alternate redundancy break-out. It could be argued that public organisations would have a higher confidence level if they were able to provision a secondary line with another provider.

5.3.3 Pressure to Deliver Service

The findings indicated that Cloud Computing had improved the organisation's ability to respond to deliver service to citizens. COVID-19 increased pressure on the public sector to provide services to its citizens. Due to isolation, these services also needed to be more accessible as many citizens had to isolate and could not access services in traditional methods. Cloud Computing became vital during this period as the organisation could now respond quickly and build various services.

The findings in this research are mostly consistent with the literature. Cloud Computing provides the competitive edge to enable high performance to provide needed solutions to a customer base (Oliveira et al., 2014). This translated in the public sector context is to respond to pressure to deliver services to its citizens. This is vital as the current perception is that service delivery from the public sector is poor (Cannon, 2015; Ngcamu, 2019). Consideration should be given that the organisation has abandoned its primary benefit of cost reduction for the ability to provide fast solutions to its citizens during the pandemic. As the organisation's perception is vital to remain in power, it could be argued that public perception of receiving services from the organisation outweighs any potential costs incurred. This assumption is based on the repetitive theme that Cloud has enabled them to provide service to citizens across all participants; this sentiment is reflected in the agility benefit.

5.4 Research Sub-Question 4

- How are actualised Cloud Computing benefits measured by South African public organisations to deem it successful?

5.4.1 Measuring Cloud Benefits

The findings indicated that most participants agreed that the organisation had not measured all of its Cloud benefits. The organisation's adoption was guided by an adoption strategy that articulated the perceived associated adoption benefits to overcome some of the current organisational issues, such as cost. These specific benefits were measured to report to departments to confirm a successful implementation. Dashboards were used to keep track of progress and to create comparative data. Most participants acknowledge that all benefits should have been measured to ensure that the full benefit of Cloud had been received after the adoption. The organisation further had not set the criteria for a successful implementation.

The findings in this research are partially consistent with the literature. Johnston, Loot and Esterhuyse (2016) state that organisations are not measuring tangible and intangible benefits. The lack of measurement has attributed to the organisation not knowing how to measure these benefits as there is no standard measurement. However, in this case, the organisation did not measure all the benefits initially as it was viewed as unimportant. Consideration to the definitions of what a successful Cloud implementation is, should be defined. Some have received all benefits, and some have not; however, all participants considered they implemented Cloud successfully. This discrepancy requires further investigation as some adoptions in other use cases could have been deemed successful, yet key benefits were not entirely received.

6. Conclusion

This study investigated a South African public sector organisation and whether or not they have actualised the perceived Cloud Computing pre-adoption benefits. This research provides an essential contribution to advancing the knowledge of Cloud Computing adoption, and post-adoption actualised benefits, attitudes, and factors that drive continued use by examining the phenomena with the research model by Hassan et al., 2017. The model proposed technology, organisation, and environment as factors for grouping the findings into major themes. This model was further utilised as a lens to understand and categorise data into sub-themes which were collected from semi-formal interviews. These findings will enhance the current understanding of how pre-adoption beliefs are altered by post-adoption actualised benefits, which compelled an innovation's continued use.

The finding indicates that the South African public sector organisation has actualised some perceived Cloud Computing pre-adoption benefits. Participants as a whole are satisfied with Cloud Computing implementation; however, this is influenced by a variety of internal and external factors and perceptions. It is important to note that some departments have not benefited equally and, in some cases, have not received the benefit at all. Most participants have indicated that they have not received the cost-saving benefit, and in some cases, increased costs by 300% (Smith, 2020). Although this high valued benefit was not received, participants indicated that the overall benefit of Cloud Computing is sufficient to overlook the cost increase. Given that there is an austerity measure in place to curb additional spending, the most likely reason for this was to remain operational during the COVID- 19 pandemic (Sibeko, 2019). This observation of continued use despite not receiving the perceived benefits is contrary to the what literature describes as normal behaviour.

Benefits such as agility and flexibility have become extremely valuable to ensure continued operations during the pandemic. Participants cited that being able to provide solutions quickly in response to changing pandemic policies has advantaged them to provide services to citizens' needs. However, post-pandemic, the value of these benefits should be reviewed as the need to be agile and flexible could decrease. Thus, benefits such as cost could be viewed in a higher value again. This observation of situational acceptance is not described in literature. Literature indicated that management support in the adoption of Cloud was an obstacle, however in the Pandemic, this obstacle was overcame and acceptance was quickly obtained to ensure continued operations.

A notable observation is that the agility and flexibility benefit does not follow the proposed organisational policies. The current services are not provisioned through the envisaged SITA government Cloud (Cannon, 2015; Ngcamu, 2019). This provisioning change can reduce the organisation’s current ability to react quickly, thus losing the benefit and reverting to the previous issues encountered with SITA’s services of long procurement periods. The organisation currently allows employees to work remotely; however, the DPSA states that this is not allowed in their contracts. This is currently allowed due to the pandemic; however, the flexibility benefit could be lost if the contract policy does not change.

Knowledge of the Cloud Computing strategy and its inner workings are not equally filtered across all organisational levels and divisions. Participants indicated that some aspects are only known by main stakeholders and not filtered down to the lower operational levels. This knowledge gap between operational and strategic participants is noticeable in differing opinions on some received benefits due to perceptions from their polar viewpoints. These perceptions are further compounded depending on

the technology type and organisational department, as the success of Cloud implementations appears inconsistent.

The cost of Cloud concerning the exchange rate has been identified as a potential risk for organisations, especially in the third world. Due to unstable economies, organisations can not predict how the exchange rate will impact Cloud services' cost and thus could have a positive or negative impact on budgets. If a significant event should happen, Cloud costs could be too expensive to maintain compared to an internal on-prem data center.

Measurement of Cloud benefits in the organisation was not considered a vital component of Cloud adoption. Some benefits were tracked, such as cost due to austerity measures. However, after its implementation, the organisation realised it was short-sighted not to track the extent they have received each benefit. Another notable observation is that there was no clear definition of a successful implementation of Cloud Computing (Johnston, Loot & Esterhuyse, 2016). Given that some benefits were not received, it can be viewed as misleading for participants to state that the implementation was successful. This could imply that other organisations are reporting a successful implementation, although many benefits were not received. Also, noting that intangible benefit has been cited as hard to measure gives more merit to this assumption. Standard measurements and a clear definition of success should be implemented to ensure more accurate data is collected.

Although some of the organisational departments have not received some benefits as envisaged due to internal and external factors. Further studies may be required post the COVID-19 pandemic and implementation of the government Cloud to confirm if perceptions have remained the same and gain a deeper insight into the decision-making process to continue the use of an innovation.

6.1 Research Contribution

Previous research in Cloud Computing focuses on the pre-adoption of Cloud Computing and not post-implementation. The benefits found in research are mostly from the vendor's perspective and not how the adopting organisation consumes it. Studies of this consumption in the context of South Africa and the public sector and how they have actualised the benefits in particular, are even less. This has highlighted some factors that have not been considered in previous studies. It is reported that some organisations do not obtain cost-saving benefits due to IT management not understanding their IT expenditure. It is not mentioned that the Cloud payment model is very different compared to on-prem, in which cost can be quickly influenced by exchange rate or minor infrastructure configurations. Organisations report on the benefit received by adopting Cloud Computing. However, these capabilities already existed prior to adoption. This thus shows an exaggeration of the degree that the organisation has benefited. Therefore, research should separate what the organisation actually received from the Cloud and pre-existing capabilities and not define a received benefit from it. Lastly, Cloud has enabled public organisations to overcome historic procurement issues in their daily operations.

6.2 Limitations

Limitations to the study carried out relate to the available pre-existing literature of Cloud Computing relating to the public sector in South Africa. Further research is needed to create comparisons and validate findings across the public sectors respectively, local, provincial, or national. Secondly, some participants were unavailable for participation due to the pandemic. Unfortunately, some critical resources had died, and these portfolios had not been replaced yet. There is a limited amount of skilled and knowledgeable Cloud resources inside the organisation, and most of the Cloud services are being outsourced. Other participants could not interview due to them remaining incapacitated from COVID-19. Lastly, this research was carried out during the COVID-19 pandemic. Organisational reliance and perspective on the utilisation of Cloud Computing have changed due to this, as found in the responses from the participants. Further research is needed post-pandemic to confirm and validate the findings of this research if the perceptions have remained the same once the dependence has decreased.

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Appendices

Appendix A: Interview Consent Form

Department of Information Systems
Leslie Commerce Building
Engineering Mall, Upper Campus
OR
Private Bag X3 - Rondebosch - 7701
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21650 2280
Internet: http://www.commerce.uct.ac.za/informationsystems/

Dear Sir/Madam,

In terms of the requirements for completing a Masters Degree in Information Systems at the University of Cape Town a research study is required.

The researcher, in this case Leigh Breda, has chosen to conduct a case study entitled Cloud Computing Benefit Realization in a South African Public Sector: A post-adoption study. The objective of the research is to understand how the organization has benefited from Cloud Computing adoption, was the benefit as expected and how is it measured.

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

The data collection method will be one-on-one interviews with a small group of the staff responsible for Cloud Computing and the management thereof. The interviews will be conducted at premise or via Microsoft Teams. and will last 45 minutes/ 1hours. If you are willing to participate in this study, kindly sign the attached form and return to me at your earliest convenience.

Should you have any questions regarding this research, please feel free to contact me on 0726176248 or email: Leigh.Breda@uct.ac.za

Your participation in this study would be greatly appreciated, but is entirely voluntary.

Sincerely,

Leigh N. Breda

Researcher \ M.Com Student, (UCT)
Department of Information Systems
University of Cape Town
Email: Leigh.Breda@uct.ac.za

Michael Kyobe

Research Supervisor
Department of Information Systems
University of Cape Town
Email: Michael Kyobe@uct.ac.za

Research Participant Consent Form

I, _____, consent to participate in the research on Cloud Computing Benefit Realization in a South African Public Sector: A post-adoption study

I am aware that participation is voluntary and that I may choose to withdraw from this study at any time, should I choose to do so.

_____ _____

Signature Date

Appendix B: Management Consent Form

Department of Information Systems
Leslie Commerce Building
Engineering Mall, Upper Campus
OR
Private Bag X3 - Rondebosch - 7701
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21650 2280
Internet: http://www.commerce.uct.ac.za/informationsystems/

Request to conduct research and interview participation consent form

Dear Sir/Madam,

In terms of the requirements for completing a Masters Degree in Information Systems at the University of Cape Town a research study is required.

The researcher, in this case Leigh N Breda, has chosen to conduct a case study entitled Cloud Computing Benefit Realization in a South African Public Sector: A post-adoption study The researcher would like to request permission to conduct this case study at your organization. The objective of the research is to understand how the organization has benefited from Cloud Computing adoption, was the benefit as expected and how is it measured.

We would like to inform you that the ethical aspect of the research ensures the preservation of the identity of the participants, the data collected will be used purely for academic purposes. All personal details will be treated with the highest form of confidentiality. Please note that participation in this research is voluntary and participants can opt out of the study at any time.

The data collection method will be one-on-one interviews with a small group of the staff responsible for Cloud Computing and the management thereof. The interviews will be conducted at premise or via Microsoft Teams. and will last 45 minutes/ 1hours. If you are willing to participate in this study, kindly sign the attached form and return to me at your earliest convenience.

Should you have any questions regarding this research, please feel free to contact me on 0726176248 or email: Leigh.Breda@uct.ac.za

Your organization's participation in this study would be greatly appreciated.

Sincerely,

Leigh N. Breda

Researcher \ M.Com Student, (UCT)
Department of Information Systems
University of Cape Town
Email: Leigh.Breda@uct.ac.za

Michael Kyobe

Research Supervisor
Department of Information Systems
University of Cape Town
Email: Michael Kyobe@uct.ac.za

Management Consent

I, _____, give the researcher of this study consent to conduct their study in the following organization:_____

I am aware that participation is voluntary and that respondents may choose to withdraw from this study at any time, should they choose to do so.

_____ _____

Signature Date

Appendix C: Interview Questions

1) What is government's attitude towards Cloud-computing adoption in government services?

2) What did you perceived to be the benefits of Cloud Computing before adoption?

A. Have these benefits been actualised after its adopted?

B. Are you satisfied by the results?

C. How are these results determined?

3) Did you perceived Cloud Computing to be easy to use before adoption?

A. Has it been easy to use after it was adopted?

B. Are you satisfied by the results?

C. How are these results determined?

4) Did you have any fears in adopting Cloud Computing?

A. Are there still concerns related to security now that you have migrated some of your services onto the Cloud?

B. Do you have trust in Cloud services now?

C. Have these fears transpired after it was adopted?

D. Are you satisfied by the results?

E. How are these results determined?

5) How did you perceived Cloud Computing would affect your costing before adoption?

A. Was it as expected after its adopted?

B. Are you satisfied by the results?

C. How are these results determined?

6) Were there any factors that influenced you to adopt Cloud Computing?

A. Is there anything currently influencing you to continue the use of Cloud Computing?

7) How has the organisation benefitted from the adoption of Cloud Computing? A. How are these results determined?

8) How has technology benefitted from the adoption of Cloud Computing? A. How are these results determined?

9) Was there skilled resources or competencies required needed in the organisation after the migration to Cloud-computing environment?

10) Do you have any issues or concerns with the Cloud Service-Level Agreement in place?

11) Are there any current regulation that are impacting the continued use or expansion of Cloud-computing adoption and development?

12) What are the main reasons you continue the use of Cloud Computing?

13) Do you have anything to add that I might have not mentioned with regards to Cloud Computing.