ADOPTION OF CLOUD COMPUTING BY SOUTH AFRICAN FIRMS: AN INSTITUTIONAL THEORY AND DIFFUSION OF INNOVATION THEORY PERSPECTIVE

RESEARCH REPORT

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DECLARATION

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

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27th Day of May 2014.

ABSTRACT

This study investigated the adoption of cloud computing as a form of innovative IT by South African organisations. The investigation into the factors that explain the current extent of adoption was focused through the lenses of Institutional Theory and Diffusion of Innovation Theory (DOI).

Cloud computing is a form of innovative IT offering an organisation the means to effectively and efficiently rent on-demand IT resources as a service. There are three generally agreed cloud services delivery models: Software-as-a-service (SaaS), Platform-as-a-service (PaaS) and Infrastructure-as-a-service (IaaS). Each of these cloud services models meets different organisational requirements and targets different customers, but what they all have in common is that each model offers advantages to organisations willing to adopt any one of them. Even though cloud computing offers advantages, it is not without its challenges and short-comings which are responsible for tempering the rate of adoption and the types of service delivery models being adopted.

The aim of this research study was to develop and subsequently test a model of the institutional pressures and IS innovation characteristics that influence organisational adoption of cloud computing. A systematic literature review was conducted to gauge the state of the field, and thereafter a research model was developed and tested using a survey methodology. This involved operationalizing the variables hypothesized in the research model and collecting data through a questionnaire instrument.

The self-administered online questionnaire was administered to a sample of 980 medium-to-large South African organisations, resulting in a final number of 87 usable responses. The data provided by these 87 organisations passed through reliability and validity tests which confirmed that the construct measures provided consistent and reproducible results (reliability) and accurately represented the constructs they were intended to measure (validity). After reliability and validity was demonstrated, correlation, regression and partial least square (PLS) structured equation modelling was employed to test the hypothesized research model.

The results of the study indicate that the *mimetic pressures* construct drawn from Institutional Theory is more important than normative and coercive pressures in explaining adoption of cloud computing, and that the DOI factors of *compatibility* and *relative advantage* were also significant. However, it is evident from results that top management championship as an internal organisational factor is very important and may mediate the effects of other factors on the adoption of cloud computing.

Cloud computing is very topical and is garnering a great deal of attention both academically and practically. Through the application of Institutional Theory and Diffusion of Innovation Theory to an IT innovation context, that of cloud computing, this study's research results provides an academic contribution. This research also offers practical implications for organisational IT decision-makers, technology service suppliers and trade bodies. For those organisations who are considering adoption of cloud computing this research will offer insights into the relative influence of institutional pressures and IS innovation characteristics and how these factors weighed on other organisations' decision-making.

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LIST OF ABBREVIATIONS

AWS	Amazon Web Services
CFA	Component Factor Analysis
CIO	Chief Information Officer
Cloud	Cloud Computing
CPU	Central Processing Unit
CRM	Customer Relationship Management Systems
DOI	Diffusion of Innovation Theory
DV	Dependent Variable
EDI	Electronic Data Interchange Systems
ERP	Enterprise Resource Planning Systems
IaaS	Infrastructure as a Service
IS	Information Systems
IT	Information Technology
IV	Independent Variable
NIST	National Institute of Standards and Technology
OS	Operating System
PaaS	Platform as a Service
PCA	Principal Component Analysis
PLS	Partial Least Squares
SaaS	Software as a Service
SEM	Structured Equation Modelling
SLR	Systematic Literature Review
TOE	Technology, Organisation and Environment
VM	Virtual Machine

1. INTRODUCTION

1.1 BACKGROUND

Cloud computing is a technology innovation that is attracting a great deal of attention amongst both academics and practitioners. Even though cloud computing is not a new concept, having evolved out of the now proven and pervasive concept of virtualisation of information technology (IT) resources, it has only recently become a fashionable term. In its current form it introduces both opportunities and challenges for organisations and IT practitioners who must weigh the benefits of adoption against cloud computing's limitations (Lin and Chen 2012).

Cloud computing offers the means to effectively and efficiently rent on-demand IT resources as a service, allowing for rapid remote access to large-scale IT resources such as hardware and software in a very efficient manner (Misra and Mondal 2011). This on-demand IT resource rental model is achieved by moving the physical ownership, processing power and storage to a single or possibly even numerous cloud computing service providers and away from an in-house organisation owned model (Wilson 2011)

Furthermore, there are three generally agreed cloud services delivery models: Software-as-a-service (SaaS), Platform-as-a-service (PaaS) and Infrastructure-as-a-service. Each of these cloud services models meet different organisational requirements and target different customers. However, common to all these models is that is that they 'rent' the use of computing resources including services, applications, infrastructures, and platforms to customers and these resources are accessed via the internet (Geczy, Izumi, and Hasida 2012).

Cloud computing holds the promise of being the "next big-thing" in IT (Sultan 2011). Established on the concept of IT resource virtualisation, it represents the next generation in the organisational delivery and accessibility of an extensive IT architecture comprising hardware and software that is delivered over the internet. It replaces the previous generations of both mainframe and client server based architectures that relied on organisationally owned IT assets with an on-demand and rapidly scalable alternative, making the latest software and hardware readily available to organisations that may previously not have had the resources to own or manage their own IT assets (Misra and Mondal 2011). But, even with cloud computing having its foundations in virtualisation which is widely adopted and being deemed the "next big-thing" by practitioners and academics, its rate of adoption by firms and consequently its diffusion into the market place is happening slower than expected. In order to better understand cloud computing adoption, this research study will draw on the perspectives of Institutional Theory and Diffusion of Innovation Theory.

1.2 STATEMENT OF THE PROBLEM

Cloud computing enables individuals and organisations to rapidly connect to data, provision IT infrastructure and access sophisticated applications (Greengard 2010). cloud computing introduces the opportunity for organisations in developing nations to access large scale remote IT resources in a very efficient manner and at a relatively modest cost; effectively eliminating the barriers to entry of purchasing expensive IT resources (Rivard, Raymond, and Verreault 2006).

Given the various industry acknowledged benefits of cloud computing, it is un-surprising that overall usage of cloud computing is on the rise across the world. According to Burns (2012), much of the research undertaken by practitioner publications identify that there is momentum building behind business adoption of cloud computing services. But, there is still some way to go before cloud computing enjoys real widespread adoption across small, medium and large organisations, with many large organisations starting to take a more strategically planned approach to the adoption of cloud computing by considering adoption in relation to existing hardware and software investments and the long-term consequences for the business.

Even with the cost benefits of using cloud services, there are still many large organisations that believe that they can achieve better economies of scale through continued direct ownership of IT assets via an in-house model. However, there is an increasing acknowledgement and behavioural shift across organisations to resist a "you-can-buy-it-and-run-it-for-less argument", with organisations understanding that cloud computing introduces efficiencies that are difficult to replicate in-house (Babcock 2012).

In research conducted by Kshetri (2010), it was discovered that cloud computing in the developing world is still in its infancy in terms of awareness and adoption across all the developing economies covered by the study, including South Africa. Table I depicts the limited application of cloud computing within South Africa.

Country	E-education	E-health	E-commerce/e-business/supply chain	E-governance	E-environment	Telecommuting
China	X	X	X		X	
East Africa	X					
India	X	X				
Korea			X			
Qatar	X					
South Africa			**X**			**X**
Turkey						
Vietnam	X			X		
West Africa					X	

Table 1: Cloud Computing Application Areas in Developing Countries (Source: Kshetri 2010)

When taking into consideration the state of cloud computing adoption globally it is necessary to understand the factors that are driving adoption. Much of the decision to adopt is attributable to the myriad benefits that cloud computing affords adopting organisations. With the ever-increasing costs of managing and owning IT and the limitations of cloud computing, it becomes increasingly clear that the managerial decision around the adoption of cloud computing is a complex one. The adoption decision needs to be made in the context of ever changing technological needs, existing investments and changing organisational demands that are placed on IT by the organisation. Add to this the limited adoption and awareness of cloud computing within the South African context and it becomes clear that better understanding some of the factors that influence the cloud computing adoption decision will offer valuable insights to both academics and practitioners alike. This in-turn informs the important research question which guides this study:

What factors are influencing the adoption of cloud computing across South African firms?

1.3 RESEARCH PURPOSE AND OBJECTIVES

Cloud computing represents the technological innovation of interest to this study. With the advantages and benefits that cloud computing introduces, it is a technology that should hold much promise for firms and its rate of adoption by firms and consequently its diffusion into the market place deserves attention. To answer the research question posed above, this study will draw on the perspectives of Institutional Theory and Diffusion of Innovation (DOI) Theory.

More specifically, this research study aims to develop and subsequently test a model of the institutional pressures and IS innovation characteristics that influence organisational adoption of cloud computing.

To achieve this aim, this research report has the following objectives:
First, the literature will be reviewed and a research model hypothesizing the effects of selected institutional pressures suggested by Institutional Theory and technology innovation characteristics suggested by Diffusion of Innovation Theory on cloud computing adoption will be developed. In addition, to the variables drawn from Institutional Theory and DOI, the research model will include necessary internal organisational factors as controls, such as top management championship, employees' IS knowledge, organisation size and innovation cost.

Second, the research model will be tested using a survey methodology. This will require that the variables hypothesized in the research model are operationalised from the literature and a questionnaire instrument developed. The research model will be tested by collecting data via the questionnaire instrument from a sample of medium to large South African organisations. For the purposes of this study internal consistency reliability will be measured using Cronbach's alpha; principal component analysis (PCA) will be used to assess convergent validity and discriminant validity. The stated hypotheses will be tested using regression and the partial least squares (PLS) approach to structured equation modelling (SEM).

1.4 THEORETICAL AND PRACTICAL IMPLICATIONS

This research applies Institutional Theory and Diffusion of Innovation (DOI) theory perspectives to explain a firm level IT innovation adoption, specifically the adoption of cloud computing in the South African context. As per Oliveira and Martins (2011), most empirical studies of IT adoption at the firm level are underpinned by DOI theory or the technology, organisation and environment (TOE) framework, with little research being undertaken using Institutional Theory. They argue that the integration of Institutional Theory and DOI may offer a more complete explanation for the phenomenon of IT innovation adoption at the firm level. Li (2008) and Kung, Kung, and Cegielski (2013) are a notable examples of the use of Institutional Theory, DOI theory and the TOE framework to explain organisational adoption of cloud computing as an IT innovation. Their example provides an illustration of the advantages of integrating multiple perspectives. Consequently, this study will combine Institutional Theory with Diffusion of Innovation Theory to explain the cloud computing adoption phenomenon. In so doing the study makes a contribution to our understanding of the relative importance of each of these theories to explanations of firm-level IT adoption.

Oliveira and Martins (2011) state that it is important to utilise more than one single theoretical model to understand complex new technology adoption. Therefore, a meaningful theoretical contribution can be made by applying Institutional Theory and DOI theory to the study of cloud computing adoption and providing empirical evidence of their relative explanatory powers. These empirical findings will help us understand whether adoption is driven more by institutional factors such as coercive pressures versus the intrinsic technology innovation characteristics such as the technology's complexity.

Results of this study will also have practical implications for organisational IT decision-makers, technology service suppliers and trade bodies. Given that the managerial decision regarding the adoption of cloud computing is complex, for those organisations that are considering cloud computing adoption the results of this research will shed light on this complex managerial decision and may help managers in their decision-making process by identifying the influence of institutional pressures and IS innovation factors that they may wish to consider, such as competitor adoption decisions, technological complexity and top management support and how those factors have come to influence other organisations.

For technology vendors in the South African market, this research will prove useful in assessing the relevant strength that these vendors can bring to bear in terms of influencing the cloud computing adoption decision.

For organisations willing to adopt cloud computing there are certainly benefits to be derived but it is contingent on organisations to ensure that adoption of cloud computing does in fact meet real needs.

1.5 ASSUMPTIONS

The first assumption is that the demand for and adoption of cloud computing within the South African context will continue to grow over the years to come, validating the reasons for this study.

The second assumption is that a sample frame of medium to large organisations is suitable, since these firms are more likely to have existing in-house IT resources and now have an opportunity through the cloud model to access additional IT applications and systems that were previously unavailable to them. Hence they are more likely to consider cloud computing adoption.

The Third assumption is that IT managers and IT decision-makers within the sampled organisations will be suitably positioned to understand their organisation's IT resources and technological environments as well as understand the organisation's current and future plans regarding these IT resources and technological environments and as a result be appropriate respondents for this study.

1.6 DELIMITATIONS

The research is conducted within the following framework:

1. The scope of the study is limited to South African firms; however the literature review is global and not only limited to South Africa. Therefore, it is assumed that the reviewed literature is applicable to the South African organisational context.
2. Cloud computing is the general name applied to either one or more of the cloud service delivery models (IaaS, PaaS, or SaaS), with the aim of explaining adoption of cloud computing through adoption of its constituent service delivery models.

3. A web-based structured questionnaire will be used for collecting cross-sectional, quantitative data from the sample frame; this is a researcher-independent technique. The data will be subjected to statistical analysis with the purpose of testing the hypotheses and drawing inferences from the findings. The results will be used to answer the research question and contribute to resolving the research problem.

1.7 ORGANISATION OF THIS REPORT

The background to the research, research problem, aims and objectives, and importance of the research were discussed in chapter one.

The remainder of the report consists of the following chapters:

Chapter Two presents a review of the relevant literature. After a more complete discussion of the cloud computing concept, the results of a systematic literature review on prior research into cloud computing is presented. The chapter concludes by illustrating the gaps in literature that are addressed in part by this study.

The theoretical background and the research model of the study will be detailed and presented in Chapter Three. Hypotheses relating institutional pressures and innovation characteristics to adoption are presented.

The research methodology will be detailed in Chapter Four. The chapter will discuss methods for data collection, including sampling, construct operationalisation and questionnaire construction. Moreover, the methods to ensure reliability and validity and to test the study's hypotheses are outlined.

Chapter Five presents a summary of the results of this study's data analysis, detailing the outcomes of the data cleaning and outlier analysis, response profiling along with a descriptive summary of cloud computing adoption, a breakdown of the results of reliability and validity tests, and finally the results of the PLS test of the structural model which conclude with a summary of the PLS findings per hypothesis.

Chapter Six provides a conclusion of the results through discussion and interpretation, linking the results to the set research objectives.

Chapter Seven is the final chapter, providing a discussion of the limitations of this study as well as future research directions. This chapter also discusses this study's implications for research and practice.

Appendices are included to provide details of the questionnaire, pilot study results, cover and reminder letters which were sent to the target sample, raw response data, and statistical output data from SPSS. References and a bibliography of cited and other relevant literature are also included.

2. LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents the literature review that was undertaken for the purposes of this research. After a more comprehensive discussion of the concept of cloud computing as well as the adoption of technology innovations, the results of a systematic literature review on prior research into cloud computing is presented. The chapter concludes by illustrating the gaps in literature that are to be addressed in part by this study.

2.2 UNDERSTANDING CLOUD COMPUTING

It is posited that cloud computing offers great potential for the future of computing. Cloud computing is a technology innovation that evolved out of the concept of virtualisation of IT resources and is built around the paradigm of offering computing resources as a scalable service delivered on-demand through a network (Goscinski and Brock 2010)

Neiger, Santoni, and Leung (2006) explain how virtualisation is a well-established concept dating back decades and involves virtualising the physical resources of a computing system with the intention of achieving improved sharing and utilisation of the underlying physical computing system's resources. Virtualisation is a key enabling technology that has paved the way for cloud computing, in turn making the offering of cloud computing services a viable business proposition for service providers (Kotsovinos 2011).

VMware is credited with pioneering the use of virtualisation on PCs and servers architected around industry-standard Intel and AMD microprocessors, thereby making virtualisation more accessible to businesses (Sacconaghi, Yin, and Garfunkel 2008). Through virtualisation, all of a system's resource including memory, CPUs, network devices and disks are virtualised, allowing for multiple operating systems (OSs) to be run on a single physical hardware appliance. This is in contrast to a non-virtualised system, whereby a single OS is run on a single physical hardware appliance and controls all of the hardware appliance's resources. Virtualisation introduces a new layer of software referred to as a hypervisor. The role of this hypervisor is to manage and co-ordinate access to the underlying physical hardware resources, thereby allowing for these resources to be shared amongst multiple OSs that are "guests" of the hypervisor. The hypervisor then presents virtual resource interfaces to each of the guest OSs, thereby constituting a virtual machine (VM) (Neiger et. al. 2006). The concept of virtualization is depicted in Figure 1.

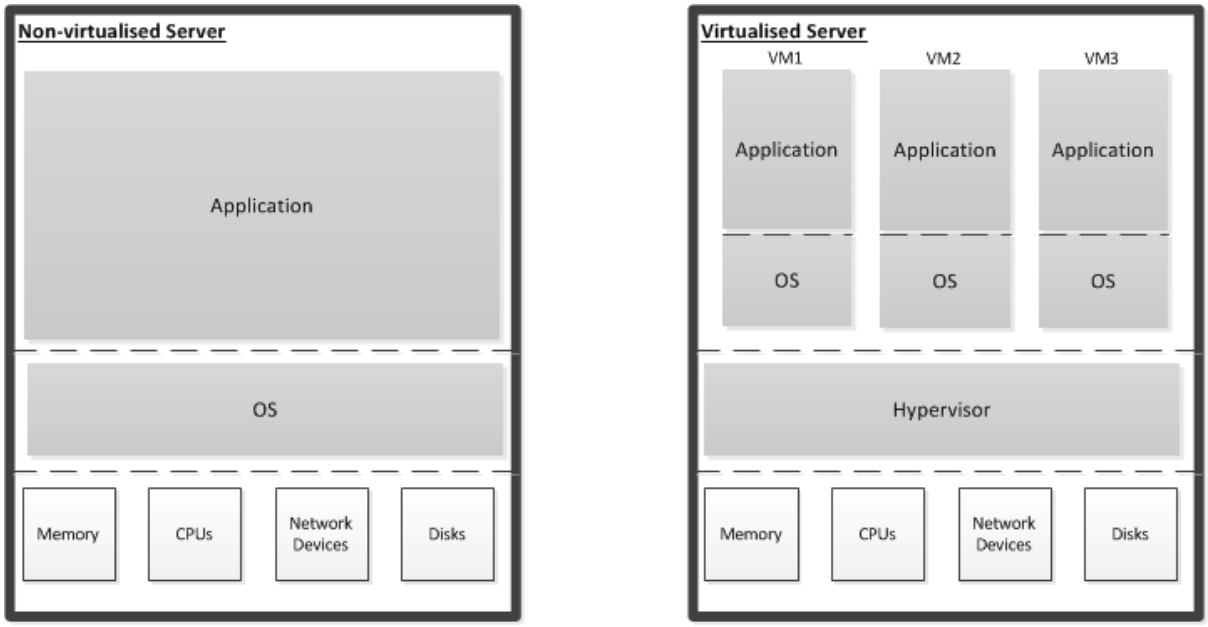

Figure 1: Conceptual Model of Server Virtualisation (adapted from Smith and Nair 2005)

The National Institute of Standards and Technology (NIST, May 2013: 19) provides a widely accepted definition of cloud computing as: "…a model for enabling on-demand network access to a shared pool of configurable IT capabilities/ resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. It allows users to access technology-based services from the network cloud without knowledge of, expertise with, or control over the technology infrastructure that supports them. This cloud model is composed of five essential characteristics (on-demand self-service, ubiquitous network access, location independent resource pooling, rapid elasticity, and measured service); three service delivery models (Software as a Service [SaaS], Platform as a Service [PaaS], and Infrastructure as a Service [IaaS]); and three models for enterprise access (Private cloud, Public cloud, and Hybrid cloud)."

The principal characteristic that differentiates the three enterprise access models of cloud-based environments, relates to the ownership of the underlying information technology resources provided. Private cloud refers to an information technology environment where the resources and services are owned by the organisation utilising them. Public cloud arises when an organisation's information technology resource needs are outsourced, hence the organisation does not own its core information technology resources and services, instead these resources are owned by outside providers. The final type is a hybrid cloud, this refers to a setup where an organisation owns its critical information technology resources and services which will be hosted and provided in-house; however non-critical services are outsourced to outside providers (Geczy, Izumi, and Hasida 2012).

The three generally agreed cloud services delivery models require further explanation: Software-as-a-service (SaaS), Platform-as-a-service (PaaS) and Infrastructure-as-a-service. The three cloud service delivery models are based on a common approach to renting the use of computing resources to customers. However, they differ in that they each meet different organisational requirements. For example, some organisations may require a server on which to deploy their applications should they either not have the computing resource capacity available or they may not have the skills to provision

a server (IaaS). Another example could involve a business need for a productivity application to meet either a short-term or long-term need without the intent to license this software directly, in this case the business can use the application on a rental basis (SaaS), hence the service delivery models target different customers and even different customer needs.

Geczy et al. (2012) derive comprehensive definitions of IaaS, PaaS and SaaS respectively. They define cloud computing as comprising all the core infrastructure components of hardware, software and additional supporting elements which are provided as a service based on a pay-per-use rental model. The hardware components can refer to complete servers or server clusters; alternately it can be at an elemental level such as Central Processing Unit (CPU) time, networking infrastructure or data storage which offers capacity for storing data and associated services such as backups. Cloud computing provides users with a complete array of computing infrastructure resources that are deliverable as services via the internet, irrespective of whether the underlying components and elements are physical or virtualised (Wang, Laszewski, Younge, He, Kunz, and Tao 2010).

Geczy et al. (2012) define PaaS as the computing platforms and solutions that are provided as services; PaaS works much like cloud computing however it introduces an additional level of service functionality in the form of the computing platforms and solutions that reside on the underlying infrastructure. PaaS is particularly well suited to the development lifecycle from application design and development through to testing as it provides a partial or full application development environment enabling developers to access computing resources for application development (Lin and Chen 2012). For many organisations PaaS offers the ability to access the computing platforms and solution necessary to effect extensive testing that would not otherwise be possible (Geczy et al. 2012).

SaaS is the highest level of abstraction in that it resides on top of the components and elements introduced by cloud computing and PaaS and makes available the functionalities of software systems which are provided over the World Wide Web as on-demand services (Dhar 2012). This layer of cloud computing service introduces a broad spectrum of applications and functionalities ranging from productivity applications such as customer relation management systems, content management systems and office productivity suites through to enterprise applications such as email services and social networking services (Wang et al. 2012).

A conceptual model of cloud computing infrastructure is depicted in Figure 2.

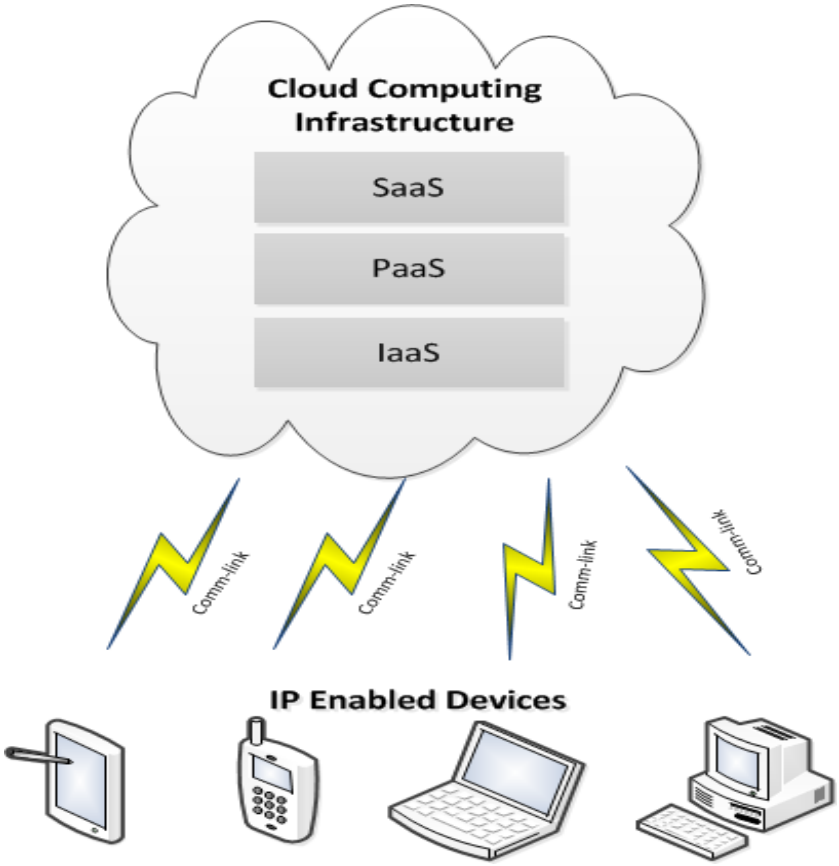

Figure 2: Conceptual Model of Cloud Computing Infrastructure (Source: Marston et al. 2011)

2.2.1 Advantages and Limitations of Cloud Computing

Cloud computing offers advantages and benefits to organisations willing to adopt. Firstly, the high rate of IT change continues to place pressure on organisational budgets with the continuous upgrades to software and hardware required to 'keep the lights on' (Sultan 2011). Given that cloud computing offers the potential to consume IT resources on a pay by use basis, the adoption of cloud computing can lead to material capital expenditure cost reductions (Dhar 2012).

Secondly, cloud computing makes access to an extensive range of IT resources available for rapid provisioning and within flexible timeframes (Wilson 2011), for example should an organisation have an urgent requirement for additional back-up storage capacity this capacity could be rapidly provided via a cloud service without the need to physically acquire and attach this storage capacity. Thirdly, a major advantage of cloud computing is its scalability, allowing for computing resources to be ramped up or down dynamically based on requirements. For example, if an electronic ticketing solutions company that is hosted in the cloud is managing a big event and finds that the demand being placed on its web server is exceeding the server's capacity to handle the load, then additional computing capacity can be dynamically allocated to the server for a short space of time in order to ensure that the server can continue processing orders. Cloud computing makes vast IT resources available to processing intensive applications, allowing for this processing power to be utilised when required (Marston, Li, Bandyopadhyay, Zhang, and Ghalsasi 2011).

Further benefits of cloud computing include the availability of backup systems, disaster recovery, and resiliency to infrastructure failures which are available from the cloud computing service provider (Misra and Mondal 2011). Furthermore, cloud computing offers a flexible and highly scalable alternative for organisations to outsource non-core and commoditised IT operations services (Dhar 2012). For example, an organisation may choose to move to a SaaS model for the business productivity tools for its users, such as Microsoft 365.

Even with all these advantages, cloud computing is not without its limitations, and it is these limitations that may temper enthusiasm and present obstacles to growth and adoption (Geczy et al. 2012). Lin and Chen (2012) identify as a major concern that there are as yet no formalised standards across cloud providers, with the implication being that interoperability and portability of data when moving between providers introduces challenges and complexity.

It is also possible that some systems within an organisation might not be compatible with a cloud computing model but might nevertheless need to interact with other cloud-based systems, making these interactions and management thereof technologically complex (Marston et al. 2011). Given that cloud computing allows for IT resources to be distributed, the IT skills and knowledge required to effectively manage and control these distributed IT resources may not exist within an organisation (Geczy et al. 2012).

Lastly, an often cited concern relates to data privacy and security (Kshetri 2010). This data privacy and security risk becomes apparent as an organisation moves from an in-house computing environment to an environment using cloud services, where monitoring and enforcement of data security on multi-tenant IT infrastructure is far more challenging than in an in-house computing environment. Furthermore for an organisation using cloud based systems e.g. SaaS, a mobile device such as a laptop or smartphone becomes the equivalent of a gateway to those systems and as a result increasing the risk of un-intended access to sensitive corporate data (Wilson 2011).

Cloud computing thus introduces both opportunities and challenges for organisations and IT professionals who must weigh the benefits of adoption against their concerns (Lin and Chen 2012).

Table 2 provides a summary of the advantages and limitations of cloud computing adoption:

Advantages of Cloud Computing	**Limitations of Cloud Computing**
IT resource cost reductions attributable to reduced capital expenditure.	No formalised and consistent standards across cloud computing service providers making portability and inter-operability challenging.
Access to extensive IT resources, hardware and software.	Possible in-compatibility between existing IT resources such as hardware and applications and cloud computing services.
Dynamic scalability of IT resources based on changing demands.	Limited IT skills and knowledge within an organisation to effectively use cloud computing.
Back-up and disaster recovery services are provided by cloud computing service providers when using their services.	Concerns around data privacy and security.
Outsourcing of non-core IT operations.	

Table 2: Advantages and Limitations of Cloud Computing (Source: Dhar 2012, Misra and Mondal 2011, and Wilson 2011)

2.2.2 Current Discussions in the Practitioner Literature

There are numerous practitioner publications [1] that publish regular articles by industry commentators and researchers regarding trends and research findings on the current topical aspects of cloud computing. As a result, the practitioner space is constantly being fed with new discussions about the myriad facets of the cloud. These include discussions about cloud service providers such as Amazon's EC2, Microsoft's Azure and Rackspace and the differences between their respective IaaS, Saas and PaaS offerings, discussions about what traditional CRM vendors such as SAP are doing in the cloud space when compared to the likes of Salesforce.com, discussions about how the traditional hardware vendors such as HP, Dell and IBM are competing to gain cloud market share, and discussions about how much debated security considerations need to be weighed up by organisations as they consider introducing cloud services into their environments.

One such practice focused article deals with the challenges faced by IT teams within organisations to build private clouds that can be supplemented by public cloud services as and when needed, effectively allowing for a blended private-public cloud architecture. IT teams in many organisations are increasingly coming under pressure to build private clouds that can achieve the same levels of flexibility and scalability of computing resources as achieved by the public clouds such as Amazon Web Services (AWS) and Rackspace. A major benefit of a private cloud is that the security and control over the data is less prevalent, since the data and access is not controlled by a third party. While there is a push for private clouds there is a concurrent push to allow for parallel access to public clouds to allow for the ability to shift workloads based on demand, a process known as 'cloud bursting', thus realising a blended private-public cloud architecture (Babcock , May 2013).

Furthermore, while organisations build out their private clouds on the back of virtualisation technologies such as VMware and Hyper-V, which together represent nearly two thirds of the virtualisation market, neither of these solutions allow for seamless integration with AWS, which is the de facto public cloud standard (Emison, January 2013).

What this points to is that even with the accessibility of well-established virtualisation solutions which are the foundational building blocks of a private cloud, building a private cloud does not necessarily lend itself to a seamless introduction of public cloud services and hence does not mean that adoption of virtualisation or private cloud will lead to adoption of public cloud services (Babcock, June 2013).

Even as organisations extend their moves into private cloud, the aforementioned blended private-public cloud model is also starting to take shape. Among the decision points tempering the introduction of public cloud services is whether or not public cloud services are in fact really less expensive than the capacity provisioned from in-house data centres, especially in the case of larger organisations. Furthermore, there is also still a belief held by large organisations that they can achieve the same operational efficiencies and economies of scale of cloud providers (Kotsovinos 2011).

A key reason for this challenge to decision-making is that it is notoriously difficult to determine with accuracy the pricing structures of in-house IT costs and then compare the in-house costs to those provided by the IaaS cloud providers in a like-for-like fashion. Most companies are un-able to state

[1] Amongst these practitioner publications are InformationWeek, Computer, and Communications of the ACM

with certainty how much it costs them to deliver a specific IT service through their in-house IT, a cost that is far easier to determine from an IaaS cloud provider (Emison, April 2013).

While large organisations may still be able to achieve operational efficiencies and economies of scale, the efficiencies achieved by in-house data centre operators are un-likely to remain on par with what cloud providers are able to achieve. The reason for this is that a cloud provider's business is built around achieving the highest levels of efficiency from the underlying resources and as the cloud vendors continue to achieve improved cost savings through scale and optimisation, in-house IT will find it difficult to match those levels of efficiency (Marko 2013).

As a result even though some organisations may be delaying the introduction of cloud services due to the scale and efficiency of their existing operations, over time there will be increasing pressure to leverage the efficiencies and cost savings that cloud vendors offer (Kotsovinos 2011).

Another key consideration arising from the practitioner literature is that of standardisation This refers to standardisation both in terms of portability as well as interoperability across IaaS, PaaS and SaaS offerings and it is the lack of standardisation that is proving to be one of the most pressing issues, after security concerns, that is prohibiting the wide scale adoption of public cloud services. There is however a growing demand for standards across the cloud landscape, this demand is being driven by buyers and sellers alike (Emison, April 2013).

There are two main drivers of the demand for standards; firstly, cloud vendors are intensely focused on demonstrating to customers that they can address the security issue that is a key blocker of wide scale adoption and secondly, potential customers want to ensure that they do not get locked into a relationship with a single vendor that could potentially limit future flexibility (Marko 2013).

When it comes to portability, the formalisation of cloud standards will allow IT teams to seamlessly move applications and data from one cloud vendor to another. Standards for interoperability will allow for cloud services be shared across multiple cloud vendors, irrespective of whether the organisation is using a private cloud, blended private-public cloud or just a public cloud (Emison, April 2013).

While cloud computing certainly introduces opportunities, the active discussions regarding private and public clouds, the costs savings and efficiencies of cloud, the lack of interoperability and portability standards and concerns around data and access security point to the fact that for many organisations familiar with in-house IT the decision to adopt cloud computing cannot be assumed. To that end, this chapter now examines how the academic literature examines the phenomenon of technology adoption.

2.3 UNDERSTANDING ADOPTION OF TECHNOLOGY INNOVATIONS

An innovation is usually defined in terms of its 'newness' (Gopalakrishnan and Damanpour 1997) as *perceived* by its adopter e.g. an individual or organisation. Thus regardless of actual time of discovery or invention, a product or process that is introduced into an adopting organisation for the first time can be deemed an innovation (Thong 1999). Because information technology (IT) based innovations are usually adopted with the intention of solving problems or exploiting opportunities in a firm, understanding the adoption of these technologies has become an important part of the information systems research agenda.

The academic literature focusing on technological innovation has identified numerous variables that have been examined to determine their effects on organisational adoption of an innovation. A large number of these studies have investigated what effect organisational characteristics have on the adoption of innovations (Lucas, Swanson, and Zmud 2007). Some such examples of these organisational characteristics that have been studied include organisation size and revenue, competitor landscape, degree of specialisation, employee skills, functional differentiation, and external integration. In addition to the organisational characteristics, the importance of individual characteristics such as management innovativeness, management attitude towards adoption of IT, and IT knowledge has also been investigated (Thong and Yap 1995).

It is generally accepted that information technology (IT) is an enabler of organisational competitiveness and is a key driver of productivity in firms. However, these benefits can only be realised if the technology is adopted. As a result of these potential benefits it is necessary to understand the key determinants of IT adoption and the various theoretical models that have been used throughout the academic literature to better understand IT adoption (Oliveira and Martins 2011).

An integrative literature review plays an important role in invigorating further research on a topic by presenting an opportunity to generate new ideas and directions for researchers (Torraco 2005). Oliveira and Martins (2011) conducted an integrative literature review of IT adoption models at firm level; what they discovered was that amongst the most prominent organisational level studies of IT adoption was that of Rogers (1995) who examined adoption through the lens of Diffusion of Innovation Theory (DOI). Another prominent model is the technology, organisation and environment (TOE) framework, introduced in 1990 (Tornatzky and Fleischer 1990). TOE identifies three aspects of an organisation's context that influence adoption: external task environment, organisation and technology. Later, Thong (1999) questioned whether adoption was better understood in terms of technology-push or market-pull and the extent to which adoption should be considered planned or reactive. Thong (1999) found that four consistent elements are identifiable in the technology innovation literature. These four elements are: characteristics of the organizational decision makers, characteristics of the technological innovation, characteristics of the organization, and characteristics of the environment in which the organisation operates.

Several recent studies have adopted an institutional approach as evidenced in the research conducted by Weerakkody, Dwivedi, and Irani (2009), whose research delved into a detailed analysis of the application of Institutional Theory. Through this research Weerakkody et al. (2009) concluded that Institutional Theory is effective for studying the organisational adoption of IS/IT. Institutional Theory

accounts for the institutional pressures such as normative pressures, coercive pressures and mimetic pressures that an organisation faces when deciding to adopt an IT/IS innovation (Weerakkody et al. 2009). However, in order to derive a better empirical understanding of the context under consideration, Institutional Theory may need to be combined with other theories and research models. For example, Diffusion of Innovation theory which focuses on adoption of innovations based on the innovation's characteristics (Oliveira and Martins 2011). Prior work has identified that the adoption of IT based innovations has been usefully considered through the integration of multiple perspective, e.g. Institutional Theory, DOI and TOE (Li 2008) and TOE and Institutional Theory (Soares-Aguiar and Palma-Dos-Reis 2008). Within this study therefore, Institutional and Diffusion of Innovation theories are considered complementary and are adopted for the purposes of this study together with a focus on some of the internal organisational characteristics as would additionally be considered in a TOE model.

The preceding sections provided extensive context of the Cloud computing concept, the various examples of cloud computing solutions available in the current market space and an overview of some of the approaches and theories used by the academic world in order to better understand the adoption of technology innovations. The upcoming section delves into the systematic literature review that was undertaken for this research in order to determine the shape and state of research into cloud computing adoption.

2.4 A REVIEW OF THE CLOUD COMPUTING ADOPTION LITERATURE

2.4.1 Background

Having established the IT artefact of interest as cloud computing and the phenomenon of interest as organisational adoption of innovative IT as viewed through the lens of Institutional Theory and Diffusion of Innovation Theory. A systematic literature review (SLR) was undertaken to determine the status on the current body of knowledge as it pertains to organisational adoption of cloud computing, and the usage of Institutional Theory and Diffusion of Innovation theory to explain organisational adoption of innovative IT.

The objective of the SLR was to identify (a) what empirical research has been undertaken into the organisational adoption of cloud computing and (b) which of this empirical research has drawn on Institutional Theory and Diffusion of Innovation Theory to explain organisational adoption of IT. In order to achieve the two aforementioned objectives, it was necessary to run two separate SLR's, specified as SLR1 and SLR2 in this section.

The SLR methodology provides a systematic and rigorous approach to the review and selection of literature that is required to understand the state of the research field for a specified phenomenon, another foundational aspect of the SLR methodology is that it allows for replicable results. The SLR methodology prescribes six steps, these steps were followed for the purposes of this study and applied to SLR1 and SLR2 respectively for the objectives stated above. Table 3 provides a summary of the steps prescribed as per the SLR methodology:

Step	Purpose
1. Define objectives and research question	The objectives and research question are used to guide and provide focus to the SLR
2. Selection of data sources	It is necessary to clearly define what information sources are to be used to address the stated objectives
3. Construction of search terms	The search terms that will be used are defined in detail
4. Specification of Inclusion/Exclusion Criteria	In order to judge which articles are of sufficient quality to be included, specific inclusion/exclusion criteria are defined
5. Data Extraction and Synthesis	The key findings from the research identified through applying the previous steps are systematically extracted and analysed
6. Writing up	The final step in the SLR whereby the findings of the SLR are stated

Table 3: SLR Methodology Steps

What follows is a detailed overview of the methodology steps as applied for SLR1 and SLR 2 to address the respective objectives, this is followed by a discussion regarding the contributions and shortcomings of prior literature as un-covered by SLR 1 and SLR 2.

2.4.2 Systematic Literature Review One (SLR 1)

Step 1:
The objective of SLR 1 was to identify what empirical research has been undertaken into the organisational adoption of cloud computing.

Step 2:
The information sources used for the literature review as well as a justification for their use are detailed in the table below:

Data source	Data Source Name	Justification for use
Electronic Database	EBSCO host academic search complete IEEE XPLORE	Provides a comprehensive full-text academic database search Provides citations and abstracts for periodicals and conference proceedings of the IEEE and IEE. Given the limited history of cloud computing, conferences could be beneficial.
Online Indexes	AIS World*	AIS World associated wiki that can be used to source theory specific research
Web Search	Google Scholar	Effective search engine to identify potential research and citations
* AIS World associated wiki on IS Theory currently maintained at http://istheory.byu.edu/wiki/Main_Page that will be used to source specific Institutional Theory research and Diffusion of Innovation research, this will be used as a supplemental data source.		

Table 4: SLR 1 Data Sources

Step 3:

Using the stated objective, the most effective way of identifying suitable research papers involved the use of search strings that were used across the respective data sources as well as some high-level filters. The filters used were English as the language, and the inclusion of an abstract. The search string was constructed by selecting a set of terms according to the framework of:

[Unit of analysis] AND [IT artefact] AND [Phenomenon of Interest] AND [Empirical nature of research]

The specific terms for the [Unit of analysis] are:

- Organisation OR
- Firm OR
- Business OR
- Company.

The specific terms for the [IT artefact] are:

- Cloud Computing OR
- Cloud OR
- SaaS OR
- PaaS OR
- IaaS OR
- Infrastructure OR
- On-demand Computing OR
- Centralised Computing OR
- Cloud Services OR
- Virtualisation

The specific terms for the [Phenomenon of Interest] are:

- Adoption OR
- Decision-making OR
- Determination OR
- Evaluation OR
- Selection OR
- Decision to use OR
- Usage.

The specific terms for [empirical nature of research] are:

- Empirical OR
- Protocol OR
- Quantitative OR

- Survey.

Herewith are some examples of the actual search strings used:

1. Organisation AND Cloud Computing AND Adoption AND Empirical
2. Firm AND Cloud AND Decision-making AND Protocol
3. Business AND SaaS AND Determination AND Quantitative
4. Company AND PaaS AND Evaluation AND Survey
5. Organisation AND IaaS AND Selection AND Empirical
6. Firm AND Infrastructure AND Decision to use AND Protocol
7. Business AND On-demand Computing AND Usage AND Quantitative
8. Company AND Centralised Computing AND Adoption AND Survey
9. Organisation AND Cloud Services AND Decision-making AND Empirical
10. Firm AND Virtualisation AND Determination AND Protocol
11. Business AND Cloud Computing AND Evaluation AND Quantitative
12. Company AND Cloud AND Selection AND Survey
13. Organisation AND SaaS AND Decision to use AND Empirical
14. Firm AND PaaS AND Usage AND Protocol
15. Business AND IaaS AND Adoption AND Quantitative
16. Company AND Infrastructure AND Decision-making AND Survey
17. Organisation AND On-demand Computing AND Determination AND Empirical
18. Firm AND Centralised Computing AND Evaluation AND Protocol
19. Business AND Cloud Services AND Selection AND Quantitative
20. Company AND Virtualisation AND Decision to use AND Survey

Step 4:

In order to ascertain which articles are of sufficient quality to be retained for further review, it is necessary to apply pre-defined inclusion and exclusion criteria. For SLR 1 the following criteria were specified:

- Inclusion Criteria:
    - Quantitative research using empirical methods.
    - Organisational level study.
    - Research pertains to an applicable IT context involving decision to use or adopt a technology.
    - Research papers that are peer reviewed.
    - Research papers that appear in conference proceedings or journals.

- Exclusion Criteria:
    - Qualitative research and methods.
    - Individual level study.
    - Practitioner based work where no research method demonstrated.

Step 5:

This step provides a view of the remaining literature after the preceding steps were executed and the inclusion/exclusion criteria applied. Included is a summary diagram used to reflect the steps and outcomes of the review process for SLR 1:

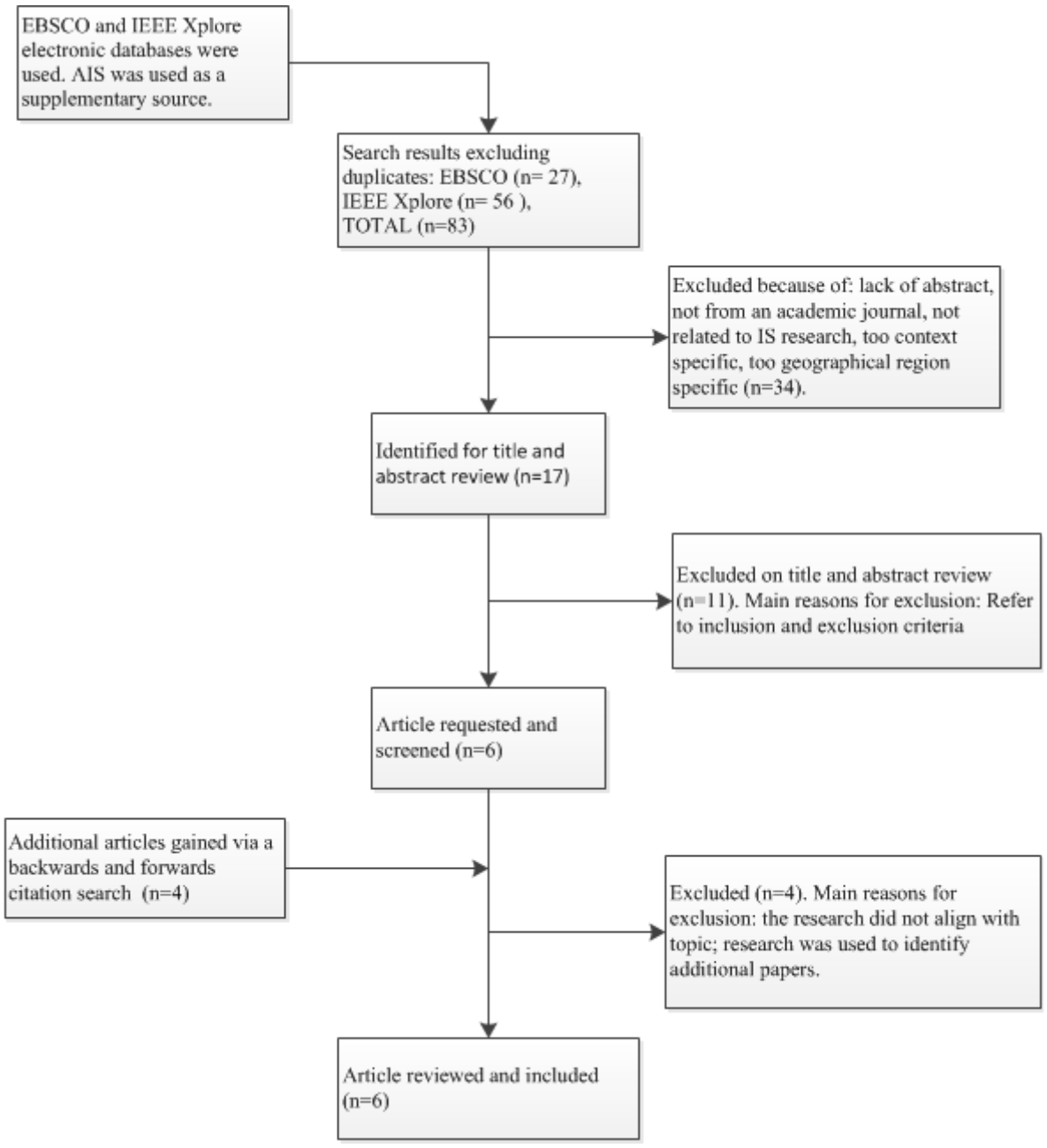

Figure 3: SLR 1 Summary

A Summary of the SLR 1 Results and Findings

After the application of the inclusion and exclusion criteria only articles of the requisite quality and content remained. These articles were then subject to a time consuming review to assess the content and finally extract and synthesise the data. Table 5 details the final six articles that were identified at the conclusion of SLR 1:

	Reading	Unit of analysis	IT artefact	Phenomenon of Interest	Author(s), Journal and Year
1.	From outsourcing to Cloud computing: evolution of IT services	Firm	Cloud Computing, On-demand Computing	Evaluation, Adoption	Dhar, S. Management Research Review, 2012
2.	Cloudsourcing: Managing Cloud Adoption	Organisation	Cloud Computing, IaaS, PaaS, SaaS	Adoption	Geczy, P., Izumi, N., and Hasida, K. Global Journal of Business Research , 2012
3.	Cloud computing as an innovation: Perception, attitude, and adoption	Company	Cloud Computing	Evaluation, Selection, Adoption	Lin, A., and Chen, N.C. International Journal of Information Management, 2012
4.	Understanding the Determinants of Cloud Computing Adoption	Firm	Cloud Computing, IaaS, PaaS, SaaS	Adoption	Low, C., Chen, Y., and Wu, M. Industrial Management and Data Systems, 2011
5.	Cloud Computing – The Business Perspective	Business	Cloud Computing, IaaS, PaaS, SaaS	Evaluation, Selection, Decision to use	Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., and Ghalsasi, A. Decision Support Systems, 2011
6.	Reaching for the Cloud: How SMEs Can Manage	Company	Cloud, Virtualisation	Adoption, Decision to use	Sultan, N. A. International Journal of Information Management, 2011

Table 5: SLR 1 Readings

2.4.3 Systematic Literature Review Two (SLR 2)

Step 1:
The objective of SLR 2 was to identify what empirical research has drawn on Institutional Theory and Diffusion of Innovation Theory to explain organisational adoption of innovative IT.

Step 2:
The information sources used for the literature review as well as a justification for their use are detailed in the table below:

Data source	Data Source Name	Justification for use
Electronic Database	EBSCO host academic search complete	Provides a comprehensive full-text academic database search
	IEEE XPLORE	Provides citations and abstracts for periodicals and conference proceedings of the IEEE and IEE. Given the limited history of cloud computing, conferences could be beneficial.
Online Indexes	AIS World*	AIS World associated wiki that can be used to source theory specific research
Web Search	Google Scholar	Effective search engine to identify potential research and citations
* AIS World associated wiki on IS Theory currently maintained at http://istheory.byu.edu/wiki/Main_Page that will be used to source specific Institutional Theory research and Diffusion of Innovation research, this will be used as a supplemental data source.		

Table 6: SLR 2 Data Sources

Step 3:
Using the stated objective, the most effective way of identifying suitable research papers involved the use of search strings that were used across the respective data sources as well as some high-level filters. The filters used were English as the language of the research and the inclusion of an abstract. The search string was constructed by selecting a set of terms according to the framework of:

[Unit of analysis] AND [Theoretical Framework] AND [Phenomenon of Interest] AND [Empirical nature of research]

The specific terms for the [Unit of analysis] are:

- Organisation OR
- Firm OR
- Business OR
- Company.

The specific terms for the [Theoretical Framework] are:

- Institutional Theory OR
- Institutional Pressures OR
- Institutional OR
- Diffusion of Innovation Theory OR
- DOI OR
- Innovation OR
- Innovative.

The specific terms for the [Phenomenon of Interest] are:

- Adoption OR
- Decision-making OR
- Determination OR
- Evaluation OR
- Selection OR
- Decision to use OR
- Usage.

The specific terms for [empirical nature of research] are:

- Empirical OR
- Protocol OR
- Quantitative OR
- Survey.

Herewith are some examples of the actual search strings used:

1. Organisation AND Institutional Theory AND Adoption AND Empirical
2. Firm AND Institutional Pressures AND Decision-making AND Protocol
3. Business AND Institutional AND Determination AND Quantitative
4. Company AND Diffusion of Innovation Theory AND Evaluation AND Survey
5. Organisation AND DOI AND Selection AND Empirical
6. Firm AND Innovation AND Decision to use AND Protocol
7. Business AND Innovative AND Usage AND Quantitative
8. Company AND Institutional Theory AND Adoption AND Survey
9. Organisation AND Institutional Pressures AND Decision-making AND Empirical
10. Firm AND Institutional AND Determination AND Protocol
11. Business AND Diffusion of Innovation Theory AND Evaluation AND Quantitative
12. Company AND DOI AND Selection AND Survey
13. Organisation AND Innovation AND Decision to use AND Empirical
14. Firm AND Innovative AND Usage AND Protocol
15. Business AND Institutional Theory AND Adoption AND Quantitative
16. Company AND Institutional Pressures AND Decision-making AND Survey
17. Organisation AND Institutional AND Determination AND Empirical
18. Firm AND Diffusion of Innovation Theory AND Evaluation AND Protocol
19. Business AND DOI AND Selection AND Quantitative
20. Company AND Innovation AND Decision to use AND Survey

Step 4:

In order to ascertain which articles are of sufficient quality to be retained for further review, it is necessary to apply pre-defined inclusion and exclusion criteria. For SLR 2 the following criteria were specified:

- Inclusion Criteria:
  - Quantitative research using empirical methods.
  - Organisational level study.
  - Research pertains to an applicable phenomenon of interest involving decision to use or adopt an innovative technology.
  - Research papers that are peer reviewed.
  - Research papers that appear in conference proceedings or journals.

- Exclusion Criteria:
  - Qualitative research and methods
  - Individual level study.
  - Practitioner based work where no research method demonstrated.

Step 5:

This step provides a view of what was remaining after the preceding steps were executed and the inclusion/exclusion criteria applied. Included is a summary diagram used to reflect the steps and outcomes of the review process for SLR 2:

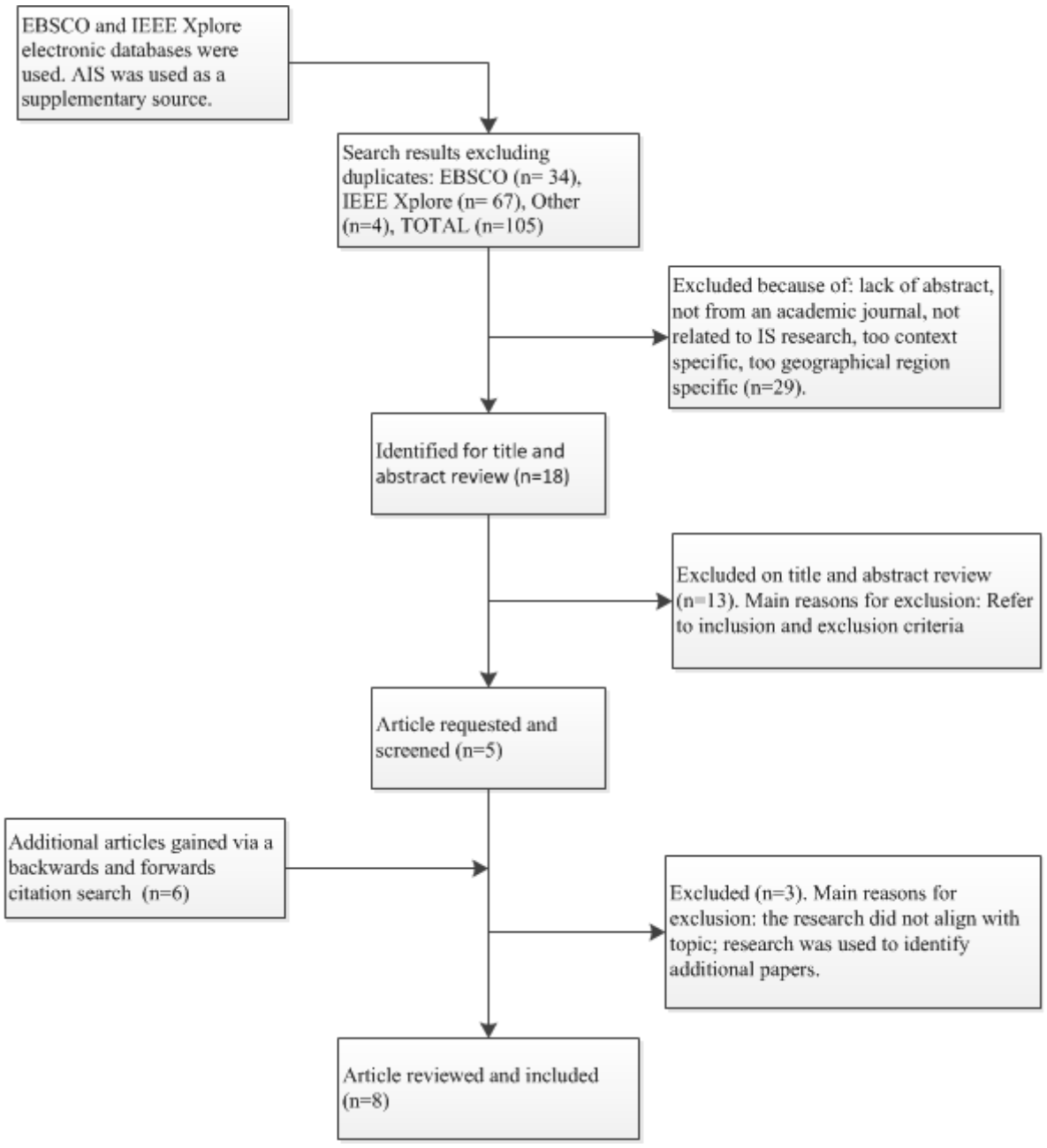

Figure 4: SLR 2 Summary

A Summary of the SLR 2 Results and Findings

After the application of the inclusion and exclusion criteria only articles of the requisite quality and content remained. These articles then went through a time consuming review to assess the content and finally extract and synthesise the data. Table 7 details the final eight articles that were identified at the conclusion of SLR 2, including two meta-studies:

Reading	IS Management Construct(s) Examined	Underpinning Theory for Determinants	Analysed Variables (dependent and independent)	IT Artefact	Author(s), Journal and Year
Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management	Assimilation	Institutional Theory	Dependent Variable: - Assimilation Independent Variables: - Top Management Beliefs - Top Management Participation - Mimetic Pressures - Coercive Pressures - Normative Pressures	Enterprise Resource Planning (ERP)	H. Liang, N. Saraf, Q. Hu, Y. Xue, MIS Quarterly, 2007
Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation	Perceptions of Adoption	Diffusion of Innovation Theory (DOI), Technology Acceptance Model	Dependent Variable: - Perceptions of Adoption Independent Variables: - Voluntariness - Image - Relative Advantage - Compatibility - Ease of Use - Trialability - Result Demonstrability	Information Technology Innovation	Moore, G.C., Benbasat, I., Information Systems Research, 1991
Implementation of Electronic Data Interchange: An Innovation Diffusion Perspective	Diffusion	Diffusion of Innovation Theory (DOI)	Dependent Variables: - Adaptation - Internal diffusion - External diffusion - Implementation success Independent Variables: - Technology compatibility - Organisational Compatibility - Relative advantage - Complexity - Costs - Communicability - Elapsed time	EDI (electronic data interchange)	G. Premkumar, K. Ramamurthy, S. Nilikanta Journal of MIS, 1994
Innovation Characteristics and Innovation Adoption Implementation : A Meta-analysis of Findings	Innovation characteristics and Innovation adoption	N/A	- Compatibility - Relative advantage - Complexity - Cost - Communicability - Divisibility - Profitability - Social approval - Trialability - Observability	Innovation Characteristics literature	L. G. Tornatzky, K. J. Klein, IEEE Transactions of Engineering Management, 1982
Literature Review of Information Technology Adoption models at Firm	Technology Adoption	N/A	- TOE Framework - Diffusion of Innovations Theory (DOI) - Institutional Theory - Iacovou et al. (1995) Model	N/A	T. Oliviera, M. F. Martins, The Electronic Journal Information Systems

Reading	IS Management Construct(s) Examined	Underpinning Theory for Determinants	Analysed Variables (dependent and independent)	IT Artefact	Author(s), Journal and Year
Level					Evaluation, 2011
Predicting Intention to Adopt Interorganisational Linkages: An Institutional Perspective	Adoption	Institutional Theory	Dependent Variable: - Adoption Intention Independent Variables: - Mimetic Pressures - Coercive Pressures - Normative Pressures	Financial Electronic Data Interchange (FEDI)	H. H. Teo, K.K. Wei, I. Benbasat, MIS Quarterly, 2003
The Diffusion and Use of Institutional Theory: A Cross-disciplinary longitudinal Literature Survey	Adoption of IS/IT	Institutional Theory	N/A	N/A	Weerakkody, V., Dwivedi, K.Y., Irani, Z., Journal of Information Technology, 2009
Understanding the Determinants of Cloud Computing Adoption	Adoption	Technology Organisation Environment Framework (TOE) and Diffusion of Innovation Theory (DOI)	Dependent Variable: - Cloud Computing Adoption Independent Variables: - Relative Advantage - Complexity - Compatibility - Top Management Support - Firm Size - Technology Readiness - Competitive Pressure - Trading Partner Pressure	Cloud Computing	C. Low, Y. Chen, M. Wu, Industrial Management and Data Systems, 2011

Table 7: SLR 2 Readings

2.4.4 Contributions and Shortcomings of Prior Literature

From SLR 1 it was found that while prior empirical academic research undertaken to better understand organisational adoption of cloud computing has contributed to our understanding of this innovative IT, there is still much to be learnt about the factors that affect organisational adoption of cloud computing, since this is still a relatively under studied area with a limited amount of research having been undertaken focusing on cloud computing as the IT artefact of interest.

Another shortcoming of the existing pool of academic research conducted to date is that much of the research focuses on the adoption of cloud computing with very few studies focusing on cloud computing's constituent parts, namely IaaS, PaaS and SaaS. There is however an abundance of articles about cloud computing in the practitioner space, however much of this work is opinion-based and lacks the empirical underpinnings of academic research work.

Furthermore, it was discovered that limited empirical research on the organisational adoption of cloud computing is available that pre-dates 2009, which supports the positioning of cloud computing as a

technology innovation. Moreover, there is limited research into the factors influencing decision-making by organisations.

Regarding the factors influencing cloud adoption, Lin and Chen (2012) concluded that cost is a factor and through the benefits of cloud computing companies are able to save costs; however there still exist concerns from IT managers and software engineers regarding the compatibility of the cloud with organisational policies, existing IT, and business needs. Furthermore, their findings also suggest that most IT companies will not adopt cloud computing until such time as the uncertainties associated with security in the cloud and standardisation are addressed. Marston et al. (2011) concluded that cloud computing represents a convergence of IT efficiency and business agility; two major trends in information technology. Through this convergence cloud computing adoption allows an organisation to benefit from IT efficiency and business agility; however the adoption decision is guided by factors such as cloud computing economics, business strategy, IS policy and regulatory issues.

The objective of SLR 1 was to identify what empirical research has been undertaken into the organisational adoption of cloud computing. Hence, it can be concluded at the end of SLR 1 that there have been some in-roads made into understanding the organisational adoption of cloud computing with the existing research contributing to the academic pool of knowledge but there remains much that can still be contributed to aid in the understanding of cloud computing as an innovative IT as well as understanding adoption of cloud computing's constituent parts.

SLR 2 uncovered some key findings from the empirical research that has drawn on Institutional Theory and Diffusion of Innovation Theory to explain organisational adoption of innovative IT. It was found that Institutional theory has been used in the past to explain adoption of IT and the effects of institutional pressures on adoption, often within very specific contexts such as Financial Electronic Data Interchange (FEDI) systems (Teo, Wei, and Benbasat 2003), Enterprise Resource Planning (ERP) systems (Liang, Saraf, Hu, and Xue 2007), and Electronic Data Interchange (EDI) systems (Premkumar, Ramamurthy and Nilakanta 1994). The empirical findings from the studies conducted by Liang et al. (2007) and Premkumar et al. (1994) support the explanatory power of Institutional Theory in respect of organisational level adoption, confirming Institutional Theory as a useful theoretical lens.

It was also found that Diffusion of Innovation Theory (DOI) is also a widely used theory to explain adoption of IT with a focus on innovative IT, with DOI being the more commonplace theory than Institutional Theory. Interestingly, some of the shortcomings identified by prior research is that in cases where either DOI or Institutional Theory were used individually, these theories were found to be less effective at explaining adoption, but when these two theories are combined they offer a better explanation (Oliveira and Martins 2011). It was also found that there are few instances where studies have combined DOI and Institutional Theory, however there are many examples where DOI and Institutional Theory respectively have been used in conjunction with TOE (Technology, Organisation and Environment) framework (Oliveira and Martins 2011). What this indicates is that there is a shortcoming in the existing literature using both DOI and Institutional Theory within an integrated research model to explain adoption of innovative IT.

Furthermore, it was discovered that there has been research into the adoption of cloud computing in the South African context. The study conducted by Hinde and Van Belle (2012) investigated the adoption and perceptions of cloud computing by SMMEs to determine whether the benefits (perceived or actual) and risks associated with cloud computing differ from those in the developed

world and whether these perceived factors differ between adopters and non-adopters of cloud computing. Madisha and Van Belle (2012) focused on SaaS readiness and adoption in small to medium sized organisations by adapting Molla and Licker's (2005a) Perceived E-Readiness Model (PERM). Lastly, the qualitative study conducted by Mohlameane and Ruxwana (2013) investigated challenges faced by small to medium organisations regarding the adoption and use of traditional solutions, and the potential of cloud computing as an alternative technology. However, none of this research has focused on using Institutional Theory and DOI to explain adoption of cloud computing in the South African context. The need to combine more than one theory to explain complex IT adoption was found to be essential in order to understand how external and internal factors affect adoption (Oliveira and Martins 2011).

Another consistent finding across the literature arising out of SLR 2 was that in the application of Institutional Theory and DOI it is necessary to control for other factors that could have an influence on adoption. More specifically, these relate to organisational level factors often considered within TOE studies. Some of these include organisation size, top management support, number of employees and IT costs.

The stated objective of SLR 2 was to identify what empirical research has drawn on Institutional Theory and Diffusion of Innovation Theory to explain organisational adoption of innovative IT. Hence, at the completion of SLR 2 it can be concluded that Institutional Theory and DOI are strong theories when used to explain organisational adoption of Innovative IT and there is a gap in the field to use these two theories to explain adoption of cloud computing within the South African context.

2.5 CHAPTER CONCLUSION

This chapter has defined the SLR methodology steps followed in order to conduct a review of the cloud computing adoption literature. Two separate SLRs were carried out to address the objectives of identifying (a) what empirical research has been undertaken into the organisational adoption of cloud computing and (b) which of this empirical research has drawn on Institutional Theory and Diffusion of Innovation Theory to explain organisational adoption of IT. It was found that although prior research has utilised DOI and Institutional theory, these two theories have never been used together within the South African context to explain the adoption of Cloud computing as a technological innovation.

It was concluded that there exists a gap in the research whereby there is little empirical research that examines the organisational adoption of cloud computing from the perspectives of Institutional Theory and Diffusion of Innovation Theory. Hence, this research will provide a meaningful academic contribution to the pool of knowledge about what is arguably a very important IT innovation that is in its early stages of adoption. Furthermore, the testing of the constructs from this research model will benefit practitioners to understand how institutional pressures and IT innovation characteristics can influence the cloud computing adoption decision.
The next chapter examines the research model developed for this study and delves into the theoretical background of the underlying independent variables derived from Institutional Theory and Diffusion of Innovation Theory. It also examines cloud computing adoption, the dependent variable.

3. THEORETICAL BACKGROUND AND RESEARCH MODEL

3.1 INTRODUCTION

In this chapter the theoretical background of the study is detailed and this study's research model is presented. The model's hypotheses relating institutional pressures and innovation characteristics to adoption of cloud computing are developed. This is followed by linking organisational factors, as control variables, to adoption.

3.2 RESEARCH MODEL

This study's research model is illustrated in Figure 3. It shows the effects of selected institutional pressures - from Institutional Theory - and technology innovation characteristics - from DOI - on cloud computing Adoption. Cloud computing adoption represents the dependent variable while the institutional pressures as well as IS innovation characteristics represent the respective independent variables. It also shows specific control variables that should be controlled for because of their influence on organisational adoption.

Drawing on these two theoretical perspectives, the model illustrates the effects of selected mimetic, coercive and normative pressures which are conceptualised as second order latent constructs that in turn are formed by a number of specific first order factors. It also reflects the DOI variables of compatibility, complexity and relative advantage. Importantly, the model includes four control variables. These are top management championship, employees' IT knowledge, organisation size and innovation cost.

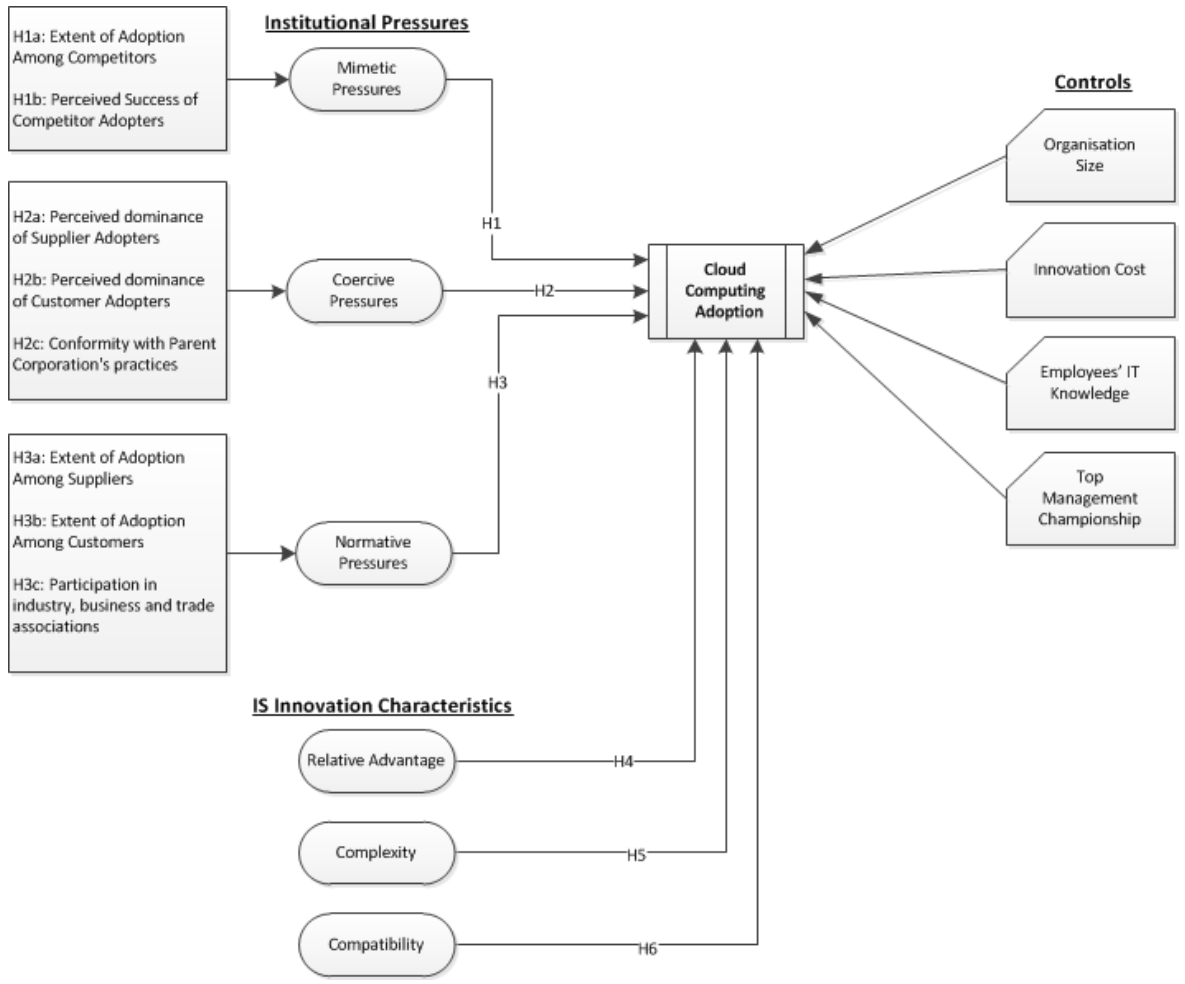

Figure 5: Conceptual Model for the Adoption of Cloud Computing

3.3 CLOUD COMPUTING ADOPTION

Referring to the research model (Figure 5), the dependent variable for this study is adoption of cloud computing. Adoption of IT can be defined as using computer hardware and software applications in the support of business operations, organisational management, and decision-making processes in the business (Thong 1999).

Cloud computing is comprised of three cloud delivery service models: IaaS, PaaS and SaaS as depicted in Figure 1. Through cloud computing, IT resources are abstracted as services which may be hosted in-house, or supplied by outside providers. IT resources offered as a service include the remote delivery and support of a full computer infrastructure, a full computer server or even specific software via the World Wide Web (Dhar 2012).

Therefore based on the definition of adoption of IT and the cloud delivery service models, this study conceptualises cloud computing adoption as the likelihood that an organisation will adopt one or more of the cloud delivery service models within the next year (Wang, Wang and Yang 2010); this study also conceptualises cloud computing adoption based on the extent to which the cloud delivery service models have been adopted by an organisation (Cooper and Zmud 1990).

3.4 INSTITUTIONAL THEORY

Institutional Theory suggests that organisations exist in an environment where organisational changes, whether these changes are structural or behavioural, are driven to a large extent by pressures on organisations to conform. It is this conformity that forms the basis of Institutional Theory (Teo, Wei, and Benbasat 2003).

DiMaggio and Powell (1983) propose three pressures through which conformity occurs: mimetic, coercive and normative pressures. Mimetic pressures can lead to an organisation changing itself over time in order to become more like other organisations in its environment. Coercive effects result from pressure being placed on an organisation to conform. These pressures originate from environmental sources that may be internal to the organisation, external to the organisation or even a combination of internal and external. Normative pressures result from the presence of dyadic relationships whereby companies share information, norms and rules as a network. The sharing of these norms through relational channels amongst the members of the network leads to consensus, which in turn leads to these norms being more deeply entrenched in an environment.

For some time already, the reasoning behind some of the enduring organisational structures and trends has been explained by means of the institutional perspective (Weerakkody et al. 2009). Institutional theory has seen greater usage in the last two decades within the social sciences, political sciences and, to a lesser degree, within information systems and technology (IS/IT) research. Institutional theory has been found to be relevant in understanding the effects of internal and external influences on organisations that are involved in change programmes, especially those involving IT-driven change. Despite a few past studies having applied Institutional Theory in the study of FEDI, ERP, and EDI adoption in an organisational context (Oliveira and Martins 2011); it is still emerging as a theoretical lens through which to understand the adoption and diffusion of IS/IT (Weerakkody et al. 2009).

In these past studies, the mimetic pressures have focused on how organisations imitate the adoption behaviours of leading peers as a response to uncertainty and promising IT/IS innovations; the coercive pressures have focused on the formal and informal adoption and compliance pressures exerted on firms by other organisations on which they are dependent. Lastly, the normative pressures have focused on the prevalent professional norms and widespread agreements that are shared by organisations in a relational network. Empirical results from those studies suggest that mimetic, coercive and normative pressures demonstrate a statistically significant effect on organisational adoption of IT/IS (Weerakkody et al. 2009).

As a result this study will therefore conceptualise mimetic, coercive and normative institutional pressures and describe how these pressures can be hypothesised to aid in the explanation of organisational adoption of cloud computing. The hypotheses derived from Institutional Theory are presented next.

3.4.1 The Effects of Institutional Pressures on Adoption

As illustrated in the research model (Figure 5), each of the three institutional pressures - mimetic, coercive and normative – are conceptualised as second order latent constructs that are in turn formed

by a number of specific first order factors[2]. These respective factors are discussed below and their effects on cloud computing adoption are hypothesised.

3.4.1.1 Mimetic Pressures

Teo et al. (2003) explain that: "…mimetic pressures may cause an organisation to change over time to become more like other organisations in its environment". It is possible for an organisation to mimic or imitate the actions and behaviours of other structurally similar organisations in the environment where the organisation exists. This can be applicable in instances where organisations share a comparable economic position in a particular industry, where both organisations produce similar goods or services, organisations have similar goals, share similar customers and suppliers, and face similar constraints.

Furthermore, these mimetic pressures may lead an organisation to adopt a practice or innovation regardless of the technical value and applicability. An organisation may do this in order to model itself after other organisations so as to acquire status-conferring legitimacy within the environment where the organisation exists (Ravichandran, Han, and Hasan 2009).

A further factor that contributes to mimetic behaviour is uncertainty. In cases where the uncertainty of returns from a managerial initiative is ambiguous and difficult to quantify, whether this initiative is a technology investment or administrative change, an organisation may simply model itself on other organisations. In many cases, an organisation may deem it to be easier and less costly to just pursue imitation (Ravichandran et al. 2009).

Hence, it is possible that an organisation considering the adoption of cloud computing may look to other similar organisations within their environment and make their cloud computing adoption determination in order to imitate other organisations in their immediate environment. This leads to the following hypothesis:

H1: Greater mimetic pressures will lead to greater adoption of cloud computing.

Mimetic pressure is however a higher-order factor comprising multiple first-order factors. This study considers two first-order factors, namely adoption of cloud computing by competitors and perceived competitor success with cloud computing. As a result, if there are enough similar organisations that function and behave in a certain manner to the extent that functioning in that manner becomes a legitimate way to function, then others will likely follow so as to avoid being identified as being less innovative or un-responsive (Teo et al. 2003).

Therefore, in the context of cloud computing adoption, the more cloud computing has been adopted in an industry the more likely it is that others in that industry will also adopt cloud computing. This is because of the pressure to conform, acquire legitimacy and avoid being perceived as lagging its competitors in technological infrastructure. As a result:

H1a: Greater extent of cloud computing adoption amongst an organisation's competitors is a mimetic pressure that will lead to greater adoption.

[2] A first order factor has a logical relationship with a second-order construct and as a result a collection of first order factors can be used to explain a second order construct.

In addition to the general pressure to conform to peer organisations and to imitate their actions, organisations are also likely to observe and imitate the behaviours of organisations that are perceived to be especially successful. The behaviours of successful organisations may be considered even more legitimate. Organisations can learn about these behaviours through observation and imitate those organisational behaviours and practice, or even avoid practices, according to their perceived impact or outcomes on the observed organisation (Soares-Aguiar and Palma-Dos-Reis 2008).

Therefore potential adopters of cloud computing are more likely to adopt if they perceive that cloud computing is a contributing factor to other organisations' successes. As a result an additional first order factor to mimetic pressures would be:

H1b: Greater perceived success of competitors, attributable to cloud computing, is a mimetic pressure that will lead to greater adoption.

3.4.1.2 Coercive Pressures

Soares-Aguiar and Palma-Dos-Reis (2008) define coercive pressures as a being a set of either formal or informal pressures that are exerted on organisations by other organisations upon which the former organisations have a dependency. This definition of coercive pressures has its foundations in the resource-dependence perspective (Teo et al. 2003). There is empirical evidence supporting the notion that an extensive variety of sources contribute to these coercive pressures, these include pressure from trading partners such as dominant suppliers and dominant customers, to regulatory bodies, and parent corporations (Ravichandran et al. 2003).

Coercive pressures have been shown to be of significance in the adoption of innovations; hence when institutionalised interdependency patterns exist across organisations within an industry or environment, the organisations within this environment are likely to exhibit similar structural features (Liang, Saraf, Hu, and Xue 2007). This is because trading partners can exert coercive pressures not only to adopt specific IT solutions, but also to improve the overall level of IT sophistication of an organisation in order to achieve cost and process efficiencies that can be achieved through effective co-ordination across the supply chain (Ravichandran et al. 2003). This leads to the following:

H2: Greater coercive pressure will lead to greater cloud computing adoption.

Coercive pressure is conceptualised in this study as a higher-order factor comprising multiple first-order factors. Firstly, an organisation's trading partners are theorised to exert coercive pressures. These partners include customers and suppliers (Teo et al. 2003).

In order to achieve improvements in efficiencies, dominant trading partners may implement new IT or IT-enabled processes, however if the benefits of the IT can only be fully exploited with the co-operation of its trading partners; such externalities can lead the dominant actors in the resource dependence relationship to use their powers to influence other firms in the relationship to invest in similar and complementary technologies (Ravichandran et al. 2009).

For example a dominant supplier can exist in scenarios where the good or service supplied is not readily available from another supplier or even when the costs of switching may be too great (Teo et al. 2003). Similarly, a dominant customer can be a customer that makes up a large proportion of an organisation's sales revenue, and these customers can easily switch to another organisation for supply of product or services (Teo et al. 2003)

Furthermore, if a dominant organisation has embarked on a journey to create sophisticated IT capabilities, the dominant organisation may impose on its trading partners the adoption of IT solutions or innovations that might be incompatible with its trading partners IT plans and vision (Soares-Aguiar and Palma-Dos-Reis 2008). It is however acknowledged that technology compatibilities across the supply chain are required in order to realise efficiency improvements and flexibility in demand fulfilment; for this reason when extensive co-ordination of activities across the supply chain is needed to compete effectively in a market, there is demand placed on trading partners within the supply chain to develop sophisticated IT capabilities and manage these capabilities effectively and in a manner that ensures compatibility across the IT architectures of collaborating enterprises. It is these demands that influence the IT investment patterns of firms in the supply chain (Ravichandran et al. 2009). Therefore, the IT investments that an organisation chooses to pursue could be influenced by the coercive pressures of its trading partners.

A dominant supplier is a source of coercive pressure that can impose on its trading partners the adoption of IT solutions or innovations. Therefore:

H2a: Greater perceived dependence on suppliers that have adopted cloud computing will lead to greater intent to adopt

Similarly, a dominant customer is hypothesized as a source of coercive pressure that can impose on its trading partners the adoption of IT solutions or innovations. Therefore:

H2b: Greater perceived dependence on customers that have adopted cloud computing will lead to greater intent to adopt.

There is another possible source of coercive pressure that arises not from a trading partner resource dependency but instead from parent corporations. It is common for parent corporations to insist that subsidiaries' practices and structures be in alignment and compatible with those of the parent corporation. Hence, parent corporations that have adopted cloud computing can apply pressure on subsidiaries to do likewise (Teo et al. 2003). Therefore:

H2c: Adoption of cloud computing by parent corporation will lead to greater intent to adopt.

3.4.1.3 Normative Pressures

Soares-Aguiar and Palma-Dos-Reis (2008) observe that normative pressures arise from dyadic relations, these dyadic relations are a form of 'social contagion', whereby a focal organisation with direct or indirect ties to other organisations learns from them through the sharing of information, norms and rules. When these norms get shared amongst the members of a relational network, consensus can be realised, this consensus in turn increases the strength of these norms and their potential influence on organisational behaviour. These normative pressures can be observed through dyadic inter-organisational channels such as the relationship between firm-supplier, firm-customer, as well as through professional, trade, business and other key organisations respectively (Teo et al. 2003).

Hence, in the context of IT adoption, the normative pressures that an organisation faces regarding the adoption of cloud computing are heightened when cloud computing has been adopted amongst its suppliers, customers and by its participation in professional, trade, or business organisations that

endorse the adoption of the IT infrastructure. This leads to the following second order factor for normative pressures:

H3: Greater normative pressures will lead to greater adoption of cloud computing.

As with the mimetic and coercive pressures, normative pressure is conceptualised as a higher-order factor comprising multiple lower-order factors. Once an IT innovation is available to an industry, members in a relational network such as suppliers and customers collectively evaluate and promote the features of the IT innovation, this evaluation and promotion in-turn shapes the institutional norms regarding the adoption of the IT innovation (Liang et al. 2007). From the perspective of a potential adopter, the perceived value of the benefits of adopting cloud computing are likely influenced by the extent that its trading partners have adopted the innovation and communicated their reasoning for doing so. Therefore, as an organisation perceives more of its relational partners adopting an innovation, adoption of the IT innovation may come to be deemed normatively appropriate for the organisation (Teo et al. 2003).

Therefore, organisations that may be considering adoption of cloud computing may be influenced by the extent of adoption among their suppliers and customers with which the organisation has direct ties. Hence, it is further hypothesized that:

H3a: Greater extent of cloud computing adoption among an organisation's suppliers is a source of normative pressure that will lead to greater adoption.

H3b: Greater extent of cloud computing adoption among an organisation's customers is a source of normative pressure that will lead to greater adoption.

Dyadic relationships are not the only mechanism through which norms are shared and communicated from organisation to organisation. Organisational decision makers rely to a certain extent on the norms, standards and solutions that are institutionalised in their environment, whether this is their business or professional circles. There are some key institutions that exert influence on organisational behaviours with respect to IT innovation adoption, these include government sanctioned bodies, standards bodies, and professional and industry associations (Teo et al. 2003).

Furthermore, through professional affiliations or vendor hosted conferences, the networking of top managers along the value chain of current or even potential trading partners is another important avenue through which normative influences can permeate (Liang et al. 2007).

The latter in particular may be a further source of normative pressure in the cloud computing adoption context. If professional bodies with which organisational decision-makers participate are active in promoting and disseminating information regarding cloud computing, those decision-makers are more likely to be positively inclined towards cloud computing:

H3c: Greater extent of participation in associations that promote and disseminate information about cloud computing is a source of normative pressure that will lead to greater adoption.

3.5 DIFFUSION OF INNOVATION THEORY

Diffusion of Innovations Theory (DOI) pivots around the diffusion of innovations and how this happens at the individual and firm level. The diffusion of innovations can be viewed as a process whereby knowledge of the innovation disseminates throughout a population, with the eventual outcome being that the innovation is either adopted or not adopted by the decision-making area within an organisation (Rogers 1983).

Prior research into the characteristics of innovations have identified specific characteristics that have been demonstrated to have an influential effect on the perceptions of potential organisational adopters towards an IS innovation (Thong 1999). Researchers have invested a great deal of time on measuring adopters' perceptions of innovations, such that this has become something of an enduring theme throughout the innovation literature.

Based on an extensive review of the technological innovation literature that delves into the characteristics of innovations, Tornatzky and Klein (1982) identify that of the twenty five innovation characteristics examined by prior research, ten were frequently utilised within the research works. The ten characteristics are: compatibility, relative advantage, complexity, cost, communicability, divisibility, profitability, social approval, trialability, and observability.

Thereafter, the meta-analysis that Tornatzky and Klein (1982) conducted, uncovered that only three of the ten characteristics were consistently found to be significant in terms of adoption of innovations. These three characteristics are: relative advantage, compatibility, and complexity. Compatibility and relative advantage were found to be positively related to adoption, while complexity was found to be negatively related to adoption (Premkumar, Ramamurthy and Nilakanta 1994). Hence, given that relative advantage, compatibility, and complexity have been demonstrated to be most significant they will be adopted for this study.

3.5.1 The Effects of Innovation Characteristics on Adoption

The adoption relationship of each of the three innovation characteristics: relative advantage, compatibility, and complexity are outlined next.

3.5.1.1 Relative Advantage

Relative advantage of an innovation can be understood as the degree to which the innovation is perceived to be better than its precursor (Thong 1999). Relative advantage was found to be positively related to innovation adoption and implementation. For the purposes of this study relative advantage describes the degree to which the cloud service delivery models of IaaS, PaaS and SaaS are perceived as being better than their IT precursors (Li 2008).

The benefits of cloud computing derive from abstracting the physical resources of a computing system and how these resources are provisioned as services so as to realise utilisation and rapid provisioning efficiencies (Low, Chen, and Wu 2011). It is assumed that these benefits lead to: lower cost of entry to access computing resources since hardware resources can be made available with no upfront capital investment, rapid provisioning in flexible time-frames, and IT barriers to innovation are reduced (Marston et al. 2011).

Positive perceptions of these and other advantages that might flow from cloud computing should provide incentive for organisations to adopt. Therefore:

H4: Perceived relative advantage of cloud computing innovations will be positively associated with the adoption of cloud computing

3.5.1.2 Complexity

Tornatzky and Klein (1982) refer to complexity of an innovation as, "the degree to which an innovation is perceived as relatively difficult to understand and use." Complexity was found to be negatively related to innovation adoption and implementation. This study views complexity as the degree to which cloud computing is perceived as difficult to understand and use (Li 2008). cloud computing is not without its complexities. For example, IT managers will need to determine which infrastructure to deploy using traditional hosting services and which infrastructure services to outsource using cloud computing (Daniels 2009). The adoption decision is further complicated by security concerns relating to how organisations will manage the data that is deployed on to cloud provisioned infrastructure as a result of the loss of physical infrastructure control (Marston et al. 2011). A final complexity relates to the lack of interoperability between cloud service providers and the standards adopted, this means that organisations will not be able to transfer easily from one cloud provider to another (Lin and Chen, 2012).

The greater these perceived complexities, the less likely will be an organisation's decision to adopt cloud computing as an IS innovation. Hence:

H5: Perceived complexity of cloud computing innovations will be negatively correlated with the adoption of cloud computing.

3.5.1.3 Compatibility

Tornatzky and Klein (1982) refer to compatibility of an innovation as, "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of the receivers." Compatibility may refer to compatibility with the values or norms of the potential adopters or may represent synergy with the existing practices of the adopters. For the purposes of this study compatibility is defined as cloud computing compatibility with the existing organisational work applications, IT infrastructures and systems as utilised by the adopting organisation (Low et al. 2011). Compatibility was found to be positively related to innovation adoption and implementation (Tornatzky and Klein 1982).

When an IS innovation is recognised as being compatible with an organisation's existing IT, the organisation is more likely to consider adoption of the technology (Low et al. 2011). Compatibility is an issue in cloud computing because there may be technology limitations on the ability to introduce cloud computing services in conjunction with an organisation's existing IT. In addition, existing work applications may not be capable of operating effectively using internet access, which is fundamental to cloud computing (Lin and Chen, 2012).

Hence, the perceived compatibility of cloud computing with an organisation's existing IT should provide positive incentive for organisations to adopt cloud computing as an IS innovation.

H6: Compatibility of cloud computing innovations with existing IT will be positively correlated with the adoption of cloud computing.

3.6 CONTROLING FOR ORGANISATIONAL FACTORS

Prior research identifies a number of additional organisational factors that should be controlled for because of their influence on organisational adoption intention. By controlling for these factors, the direct effects of the institutional pressures and IS innovation characteristics can be better isolated.

3.6.1 Organisation Size

Organisational size can be determined based on number of employees and revenue. The underlying premise here is that larger organisations have additional capacity; this refers to capacity to purchase expensive innovations, withstand operational failures, and ensure contingency measures in the form of running systems in parallel allowing for phasing out of legacy IT. The converse of this is that smaller organisations are more focused on survival and are less likely to possess additional slack capacity. Small organisations are therefore less likely to withstand cloud computing adoption hurdles (Liang et al. 2007).

3.6.2 Top Management Championship

The role of top management championship can be understood through two key conceptual stages through which top management supports an organisation initiative, namely top management beliefs and top management's active participation. Top management beliefs refer to the extent to which top management believes that an IT innovation can potentially benefit an organisation. On the other hand, participation reflects top management actively participating in the management of an IT innovation adoption, focusing on the behaviour and actions performed to facilitate and overcome hurdles to IT innovation adoption (Liang et al. 2007). Together these beliefs and actions reflect top management's championship of the innovation. Cloud computing adoption is less likely to occur in those organisational contexts where top managers fail to champion adoption efforts.

3.6.3 Innovation Cost

Innovation cost is assumed to have an inverse relationship to the adoption and implementation of an IS innovation, whereby the less expensive the IS innovation, the higher the likelihood that it will be quickly adopted and implemented (Tornatzky and Klein 1982). Through Tornatzky and Klein's (1982) meta-analysis of findings, cost was found to have a statistically non-significant relationship to an organisation's decision to adopt an IS innovation. However, it is none-the-less included given that economic feasibility is an important criterion in the investment decision. Innovation cost includes both investment cost and switching costs.

3.6.4 Employees' IT Knowledge

A key aspect of the learning perspective is that improvements in assimilation are realised when organisations have prior experience in a given area that has allowed the organisation to build knowledge, this knowledge relates to the ability to assimilate external information and apply it internally. This ability is termed absorptive capacity and based on previous research it is believed to be a key component in an organisation's innovative capability. Absorptive capacity has also been used as a means of explaining IT usage in organisations (Liang et al. 2007).

Furthermore, empirical evidence exists that supports the view that organisations with employees who have knowledge of an IS innovation will be more likely to use more of the innovation (Thong 1999).

3.7 CHAPTER CONCLUSION

Chapter 3 detailed this study's research model, and went on to describe the hypotheses relating to institutional pressures drawn from Institutional Theory and the innovation characteristics hypotheses drawn from Diffusion of Innovation Theory. The hypotheses are summarized in Table 8 below.

Hypothesis	Description
H1	*Greater mimetic pressures will lead to greater adoption of cloud computing.*
H1a	*Greater extent of cloud computing adoption amongst an organisation's competitors is a mimetic pressure that will lead to greater adoption.*
H1b	*Greater perceived success of competitors, attributable to cloud computing, is a mimetic pressure that will lead to greater adoption.*
H2	*Greater coercive pressure will lead to greater cloud computing adoption*
H2a	*Greater perceived dependence on suppliers that have adopted cloud computing will lead to greater intent to adopt*
H2b	*Greater perceived dependence on customers that have adopted cloud computing will lead to greater intent to adopt.*
H2c	*Adoption of cloud computing by parent corporation will lead to greater intent to adopt.*
H3	*Greater normative pressures will lead to greater adoption of cloud computing*.
H3a	*Greater extent of cloud computing adoption among an organisation's suppliers is a source of normative pressure that will lead to greater adoption.*
H3b	*Greater extent of cloud computing adoption among an organisation's customers is a source of normative pressure that will lead to greater adoption.*
H3c	*Greater extent of participation in associations that promote and disseminate information about cloud computing is a source of normative pressure that will lead to greater adoption.*
H4	*Perceived relative advantage of cloud computing innovations will be positively associated with the adoption of cloud computing*
H5	*Perceived complexity of cloud computing innovations will be negatively correlated with the adoption of cloud computing.*
H6	*Compatibility of cloud computing innovations with existing IT will be positively correlated with the adoption of cloud computing.*

Table 8: Summary of Hypotheses

The next chapter presents the research methodology adopted to test the above hypotheses. It will discuss the data collection method applied, the survey instrument, and the analysis strategy. A discussion of the limitations of the adopted methods is also presented.

4 RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter defines the research methodology used to address the study's objective and test the hypothesized research model. It discusses the methods for data collection, including sampling, construct operationalisation and questionnaire construction. Moreover, the methods to ensure reliability and validity and to test the study's hypotheses are outlined. Finally, this chapter looks at the ethical considerations as well as the limitations of the research methods employed by this study.

4.2 RESEARCH DESIGN

Leedy and Ormrod (2010) describe research as being a systematic process involving the collection, analysis and interpretation of data for the purposes of better understanding a phenomenon of interest. Research typically has eight distinct characteristics (Leedy and Ormrod, 2010):

1. Research originates with a problem statement or question to be answered
2. Research requires a clearly articulated goal
3. A research plan is needed to proceed
4. The principal problem is often times divided into sub-problems
5. The research problem, question or hypothesis will be used to guide the research
6. Research will make allowance for critical assumptions
7. Data collection and interpretation will be required to resolve the research problem
8. Research is a cyclical process

According to Creswell (2009), empirical research involves data of two main types. The first type is quantitative data; this type of data takes the form of numbers. The second type of data is qualitative; this type of data is mostly in the form of words. Given that questions are a key characteristic of research, it is worth noting that research questions may require different methods to answer them, such that quantitative questions require quantitative methods and qualitative questions require qualitative methods to answer them (Punch 2005). This research is empirical and specifically of a quantitative nature, making use of numbers to interpret the gathered data.

Another important aspect of research is whether it is positivist in nature; positivism is generally associated with quantitative research methods such as surveys (Pinsonneault and Kraemer 1993). Orlikowski and Baroudi (1991) identify that the positivist research perspective has been found to be dominant throughout information systems research. Being rooted in logical positivism, this perspective reflects some foundational principles such as the phenomenon of interest being single and tangible, the researcher and the object of inquiry are independent and lastly, the existence of uni-directional cause and effect relationships that are identifiable and testable using logic and analysis.

Orlikowski and Baroudi (1991) go on to discuss the key assumptions underlying the positivist perspective. The first assumption is that there exists a one-to-one relationship between the research model's constructs and the events, objects or features of interest. In this relationship the researcher is seen to play an entirely neutral role in the investigation without intervening in the phenomenon of interest being studied. Secondly, it is assumed that theories are empirically testable, whether the

intention of the test is the verification or the falsification of the theory's hypotheses. This method is referred to as the hypothetic-deductive method and there are two consequences of this method: firstly, positivist researchers work in a deductive manner to discover causal relationships that are generalisable so as to predict patterns of behaviour. Secondly, there exists a bond between explanation, prediction and control of an event or action; such that understanding the principles and premises up-front will enable the prediction and control of the event or action.

The third assumption described by Orlikowski and Baroudi (1991) regarding the relationship between theory and practice, describes this relationship as being technical; this is based on the premise that if the appropriate general laws are known, the initial conditions can be manipulated in such a way as to produce a desired state. Since researchers are believed to be impartial, they can objectively evaluate actions or processes without getting involved in subjective opinion. The fourth and final assumption about the positivist perspective is that it has led to the institutionalisation of certain validity and rigor criteria, as well as replicability of scientific research. Thereby enforcing standards of quality in empirical research, and establishing a tradition of cumulative knowledge.

Orlikowski and Baroudi (1991) also outline two of the most salient limitations of the positivist perspective as being firstly that the search for universal laws can lead to historical and contextual conditions as triggers for events being disregarded and secondly that the organisational usage of information technology is intrinsically bonded to social contexts that are affected by time, place, politics and culture.

There are three main quantitative research design types: experimental, quasi-experimental and non-experimental (Punch 2005). The intention of experimental research is to test cause-effect relationships in a precisely controlled setting, this is achieved through a separation of the cause from the effect in time; the cause is then administered to a group of randomly selected subjects and not to another randomly selected group of subjects (the control group), the mean of the effects between these two groups is then observed. Should random subject assignment between groups not be followed, then the research design becomes quasi-experimental; this research design can be conducted in an artificial or laboratory setting. The third research design is non-experimental, this design does not control for or manipulate independent variables, and instead this design calls for the measurement and testing of the effects of these variables using statistical methods (Creswell 2009). Table 9, from Punch (2005), provides a summary of the differences between these quantitative research design types.

Experiment	**Quasi-experiment**	**Non-experiment (Correlational Survey)**
Independent variable manipulation	Naturally occurring treatment groups	Naturally occurring variation in independent variables
Random subject assignment to groups	Statistical control of variables	Statistical control of variables

Table 9: Quantitative Research Designs

Relational (correlational) research, sometimes referred to as explanatory or analytical research is a quantitative research design characterised by the researcher seeking the underlying explanations for observed phenomena or problem areas (Bhattacherjee 2012). This form of research endeavours to answer the why and how of a phenomenon or problem area. These questions of why and how are answered by focusing on the development and testing of a research model, built on one or more

underlying theories, with a view to providing correlational evidence of the association between the various variables as outlined in the research model (Bhattacherjee 2012).

This research study follows the positivistic perspective, adopting both empirically quantitative research questions and methods. Furthermore, this research is relational in nature, given that it is focused on testing the hypothesized effects of a set of independent variables drawn from Institutional Theory and Diffusion of Innovation Theory on organisational adoption as a dependent variable.

The survey methodology is one of the most popular designs for a correlational study and will be utilised in this study. The methodology involves the use of a standardised questionnaire to collect data in a systematic manner from respondents (Creswell 2009).

According to Bhattacherjee (2012), survey research provides various benefits when compared to other research methods. Some of these benefits include: surveys provide an effective means of measuring a wide variety of unobservable data, survey research is well suited to remotely collect data from large populations, surveys are un-obtrusive in nature, and lastly survey research is economical from the perspective of researcher time, cost and effort. A limitation of the cross-sectional field survey is that the data on independent and dependent variables are collected at the same point in time when the survey is administered and hence temporal precedence and therefore causality cannot be established.

4.3 DATA COLLECTION

4.3.1 Population and Sampling

A population, also referred to as unit of analysis, may be a person, group, organisation, country, object, or any other entity that a researcher wishes to study. For this study the unit of analysis is the organisational level and the population of interest is South African organisations.

Given that the population stated above is too broad to study and it is not possible to investigate all organisations, a sample is needed. A sample is a subset of the unit of analysis, effectively a generalisable sample that is representative of the greater population (Pinsonneault and Kraemer 1993). For the purposes of this study the focus is on medium to large South African organisations. The reason for this focus is that medium to large organisations are more likely to have a varied range of IT resources ranging from infrastructure to applications and systems and hence more likely to consider cloud computing adoption.

This study utilised McGregor's Who Owns Whom Directory (2013) as the sampling frame for identifying the medium-large organisations that will be targeted for inclusion in the study. Who Owns Whom is a set of annual directories providing the relationship between companies showing who the ultimate parent company is and who are their subsidiaries. Some of the details made available through the directory include parent name, address and telephone number for each parent company along with the names of the subsidiaries. All types of industries are covered, ranging from agriculture to financial services and public administration. Furthermore, public and private companies are covered as well as official bodies such as governments, nationalised industries and state holding companies which have subsidiaries. A total of 980 medium-to-large South African organisations were targeted where details of the IT decision-makers within the organisations were specified.

IT managers and IT decision-makers within the sampled organisations were invited to participate in the study by completing the questionnaire because they are well positioned to understand their organisation's IT resources and technological environment as well as understand the organisation's current and future plans regarding the IT resources.

4.3.2 Procedure for Data Collection

In-line with the adoption of a non-experimental research design approach, the data collection procedure used for this study is a cross-sectional field survey whereby independent and dependent variables will be measured at the same time using a single questionnaire administered online via a web-survey tool. The survey method is a researcher-independent technique that offers both strengths and weaknesses; these strengths and weaknesses are presented in table 10.

Survey Research: Strengths	Survey Research: Weaknesses
The ability to measure unobservable data, such as people's preferences, traits, beliefs and attitudes.	Data may be unreliable: • Respondents may be unfamiliar with the phenomenon being studied • Respondents may select responses without properly reading the questions • Respondents may select socially desirable responses rather than accurate responses.
From the perspective of respondents questionnaire surveys are unobtrusive and preferred by many respondents.	Lack of flexibility: • Once questionnaires are issued the survey items cannot be adjusted to either add new items or amend existing items. • Poor planning may result in unusable data
Questionnaire surveys allow for large-scale, remote data collection.	Dependency on instrumentation validity: • If prior instruments are flawed or inaccurate then data quality suffers • Selection and wording of items directly affects validity and reliability of collected data.
Due to the researcher independent nature of questionnaires, they are economical in terms of time, effort and cost; especially when compared to other methods.	

Table 10: Strengths and Weaknesses of Survey Research

Administering a survey questionnaire online is likewise beset with strengths and weaknesses. The Strengths and weaknesses of using a web-survey tool are presented in Table 11.

Web-survey Tool: Strengths	Web-survey Tool: Weaknesses
Low cost method that is inexpensive to administer	Data can be compromised if the survey website is not password-protected
Respondents' results are instantly and securely recorded in an online database	If multiple submissions are permitted, the results can be compromised
Ability to modify existing survey items or add new survey items if needed.	Sampling bias: • Survey cannot reach subjects without computer or Internet access • Sample is skewed toward younger demographic
Administered over the Internet using interactive forms, accessed via a link	

Web-survey Tool: Strengths	Web-survey Tool: Weaknesses
embedded in e-mails to respondents	

Table 11: Strengths and Weaknesses of Web-survey Tools

4.4 THE RESEARCH INSTRUMENT

Measurement can be understood as being a comparison whereby a thing or concept is measured against a point of limitation; to that end it is possible to think of any form of measurement for construct items as falling into one following four categories, or scales: nominal, ordinal, interval, and ratio; with the scale of measurement ultimately dictating the statistical procedures that can be used in analysing the data (Leedy and Ormrod 2010).

A summary of the scale types, distinguishing characteristics and the statistical analysis implications for each scale is presented in Table 12, drawn from Leedy and Ormrod (2010).

Measurement Scale	Characteristics	Statistical Implications
Nominal Scale	Measurement based on names or designations of discrete units or categories	Allows for determination of the mode, the percentage values, or the chi-square
Ordinal Scale	Measurement in terms of such values as "more" or "less," "larger" or "smaller," but does not specify the size of the intervals	Allows for determination of median, percentile rank, and rank correlation
Interval Scale	Measurement in terms of equal intervals or degrees of difference, with the zero point, or point of beginning, being arbitrarily established	Allows for determination of the mean, standard deviation, and product moment correlation; supports inferential statistical analyses
Ratio Scale	Measurement in terms of equal intervals and an absolute zero point of origin	Allows for determination of the geometric mean and the percentage variation; supports inferential statistical analyses

Table 12: Summary or Measurement Scales

The Likert scale is a very popular rating scale for the measurement of ordinal data; this scale includes Likert items which are simply-worded statements allowing respondents to indicate the extent of their agreement or disagreement on a scale, be it a five-point or seven-point scale, ranging from a "strongly agree" to "strongly disagree". A major benefit of using Likert items is that they allow for more granularity than binary items, giving respondents the ability to indicate whether they are neutral to the statement (Bhattacherjee 2012).

According to Bhattacherjee (2012), a research instrument comprises all of the refined construct items; this instrument is then administered to a pilot test group of respondents who are drawn from the target population. The research instrument used for this study is a structured questionnaire. This questionnaire used close-ended questions. For this research, scale items adopted from past studies were used as far as possible. By utilising the measures discovered in the academic literature, content validity is ensured.

The questionnaire comprised five parts:

1. The first part covers the demographic characteristics of organisations. (Q1-Q7)
2. The second part covers adoption of cloud computing based on adoption of IaaS, PaaS and SaaS respectively. (Q8-Q14)
3. The third part covers the eight institutional pressures as per the research model, each of which was measured using multiple items. (Q15-Q37)
4. The fourth part of the questionnaire collects data on the three IS innovation characteristics which are relative advantage, complexity and compatibility. (Q38-Q48)
5. Finally, the fifth part covers the control variables. (Q49-Q62)

Cloud computing adoption is operationalised in a manner consistent with both Teo et al. (2003) and Liang et al. (2007). Intention to adopt cloud computing is measured as a reflective construct whereby respondents were asked to indicate whether they have adopted cloud computing and if so whether they have adopted IaaS, PaaS or SaaS, how likely are they to adopt IaaS, PaaS or SaaS within the next year (Teo et al. 2003).

The remaining measures of cloud computing adoption refer to the extent to which cloud computing solutions are replacing legacy technologies within the organisation, the extent to which cloud computing services are currently used to deliver the technologies that support the business operations of the organisation and the extent to which cloud computing services are currently used to deliver the technologies that support management decision making within the organization; these measures were operationalised by means of a five-point scale with which respondents indicated the extent of cloud computing adoption as 1 = 0% extent and 5 = 100% extent (Liang et al 2007). Table 13 shows the adoption construct, questionnaire items and the primary sources of the items that were used to measure cloud computing adoption; furthermore the question numbers stated refers to the numbering in the questionnaire as found in Appendix C. Question nine (Q9) through to question fourteen (Q14) constitute the measures for the dependent adoption variable, while question eight (Q8) is for descriptive purposes.

Constructs	**Variables**	**Questionnaire Items**	**Primary Source**
Adoption	Cloud Computing Adoption	Q8. My company has adopted cloud computing, if so indicate which service delivery models have been adopted? (IaaS, PaaS, SaaS)	Liang et al. 2007 and Teo et al. 2003
		Q9. How likely is that you will adopt IaaS (Infrastructure as a Service) within the next year?	
		Q10. How likely is that you will adopt PaaS (Platform as a Service) within the next year?	
		Q11. How likely is that you will adopt SaaS (Software as a Service) within the next year?	
		Q12. To what extent are cloud computing solutions replacing legacy technologies within your organisation?	
		Q13. To what extent are cloud computing services currently used to	

Constructs	Variables	Questionnaire Items	Primary Source
		deliver the technologies that support the business operations of your organisation?	
		Q14. To what extent are cloud computing services currently used to deliver the technologies that support management decision making within your organization?	

Table 13: Cloud Adoption - Constructs, Variables and Sources

As per the research model, the mimetic pressures construct is a second order construct formed from two first order sub-constructs. The first sub-construct is the extent of adoption by competitors and this sub-construct is operationalised using a five-point scale to measure the perceived extent of adoption by competitors, 1 = 0% extent and 5 = 100% extent (Teo et al. 2003). In order to enrich understanding of the extent of adoption by competitors a measure was introduced to identify which cloud computing service models or combination thereof have been adopted by a firm's competitors. The second sub-construct, the perceived success of adoption by competitors, is operationalised by means of a five-point scale with which respondents will indicate the extent to which competitors that have adopted cloud computing have benefited, 1 = 0% extent and 5 = 100% extent (Teo et al. 2003).

Coercive pressures are a second order construct formed from three first order sub-constructs. The first of these sub-constructs is perceived dominance of supplier adopters, and is operationalised by asking the respondents to indicate whether competitive conditions within the industry require them to use cloud computing and whether suppliers require them to use cloud computing (Liang et al. 2007). The second sub-construct is perceived dominance of customer adopters, a similar set of questions will be used to operationalise this sub-construct as per perceived dominance of supplier adopters (Shi et al. 2008). The third sub-construct is conformity with the parent corporation's practices, and will be operationalised using a surrogate binary variable to indicate whether the parent corporation has adopted cloud computing, 1 = adopted and 0 = not adopted (Teo et al. 2003).

The final second order construct is normative pressures which are formed from three sub-constructs. The first sub-construct is the extent of cloud computing adoption by suppliers and this sub-construct is operationalised using a five-point scale to measure the perceived extent of adoption by suppliers, on the scale 1 reflects zero extent and 5 reflects 100 percent extent. The second sub-construct is the extent of cloud computing adoption by customers and this sub-construct is also operationalised using a five-point scale to measure the perceived extent of adoption by suppliers, on the scale 1 reflects zero extent and 5 reflects 100 percent extent (Teo et al. 2003). The third sub-construct is participation in professional, trade, and business bodies, and is operationalised by asking respondents whether they are members of or participate in any such bodies that endorse cloud computing, 1 = yes and 0 = no (Teo et al. 2003). In order to further enrich understanding of the effects of participation in professional, trade, and business bodies, additional measures were introduced asking the respondents whether there is much talk of cloud computing going on in the media and whether there is a message that in order to stay in business then cloud computing needs to be adopted (Kostova and Roth 2002).

Table 14 presents questionnaire items used to measure the mimetic, coercive and normative variables respectively, as well as the primary sources of the items.

Constructs	Variables		Questionnaire Items	Primary Source
Institutional Pressures	Mimetic pressures (Second Order Construct)	The extent of adoption by competitors	Q15. What is the extent of cloud computing adoption by your firm's competitors currently?	Teo et al. 2003
			Q16. Of your firm's competitors that have adopted cloud computing, which cloud computing service models have they adopted? (IaaS, PaaS, SaaS)	
		The perceived success of adoption by competitors	Q17. Our main competitors that have adopted cloud computing are benefiting greatly?	Teo et al. 2003
			Q18. Our main competitors that have adopted cloud computing are perceived favourably by others in the same industry?	
			Q19. Our main competitors that have adopted cloud computing are perceived favourably by suppliers?	
			Q20. Our main competitors that have adopted cloud computing are perceived favourably by customers?	
			Q21. Competitive conditions in our industry require our firm to use cloud computing solutions?	
	Coercive pressures (Second Order Construct)	Perceived dominance of supplier adopters	Q23. Our main suppliers require us to use cloud computing solutions?	Liang et al. 2007
			Q25. Many of our transactions with suppliers can only be accomplished if we used cloud computing?	
			Q30. Our main suppliers that have adopted cloud computing are benefiting greatly?	
		Perceived dominance of customer adopters	Q22.Our main customers require us to use cloud computing solutions?	Shi et al. 2008
			Q24.Many of our transactions with customers can only be accomplished if we used cloud computing?	
			Q26. Our interactions with other businesses force us to use cloud computing?	
			Q33. Our main customers that have adopted cloud computing are benefiting greatly?	
		Conformity with the parent corporation	Q27. Our parent company requires us to use cloud computing?	Teo et al. 2003
	Normative pressures (Second Order Construct)	Extent of adoption by organisation's suppliers	Q28. What is the extent of cloud computing adoption by your firm's suppliers currently?	Teo et al. 2003
			Q29. Of your firm's suppliers that have adopted cloud computing, which cloud computing service models have they adopted? (Iaas, PaaS, SaaS)	

Constructs	Variables		Questionnaire Items	Primary Source
		Extent of adoption by organisation's customers	Q31. What is the extent of cloud computing adoption by your firm's customers currently?	Teo et al. 2003
			Q32. Of your firm's customers that have adopted cloud computing, which cloud computing service models have they adopted? (Iaas, PaaS, SaaS)	
		Participation in professional, trade and business bodies	Q35. There is a great deal of conversation about cloud computing going on in the media?	Kostova and Roth 2002
			Q36. There is a very strong message in companies that you can't stay in business nowadays if you do not adopt cloud computing?	
			Q37. Do you participate in any industry, trade or professional bodies where you have been exposed to cloud computing promotion and information?	Teo et al. 2003

Table 14: Institutional Pressures - Constructs, Variables and Sources

The IS innovation characteristics items: relative advantage, complexity and compatibility, are all operationalised using a five-point likert scale representing a range from "strongly disagree" to "strongly agree", with reference to cloud computing adoption (Low et al. 2011). The IS innovation characteristics constructs, variables and questionnaire items are presented in Table 15.

Constructs	Variables	Questionnaire Items	Primary Source
IS Innovation Characteristics	Relative Advantage	Q41. My company expects cloud computing to help lower on-going hardware and software costs?	Low et al. 2011
		Q42. My company expects cloud computing to provide a rapid hardware and software provisioning capability?	
		Q43. My company expects cloud computing to help reduce company owned hardware and software?	
	Complexity	Q38. My company believes that cloud computing is conceptually difficult to understand from a technical perspective?	Low et al. 2011
		Q39. My company believes that cloud computing implementation is a complex process?	
		Q40. My company believes that using cloud computing is difficult?	
	Compatibility	Q44. The changes introduced by cloud computing are consistent with my firm's values?	Low et al. 2011
		Q45. Cloud Computing is compatible with my company's existing hardware and software?	
		Q46. Cloud Computing is compatible	

Constructs	Variables	Questionnaire Items	Primary Source
		with my company's existing IT applications?	
		Q47. The changes introduced by cloud computing are consistent with my firm's existing policies and procedures?	
		Q48. Cloud Computing adoption is compatible with my firm's existing experiences with similar solutions?	

Table 15: IS Innovation Characteristics - Constructs, Variables and Sources

There are four control variables specified as per the research model. Organisation size is operationalised using number of employees, number of IT staff and revenue as per Liang et al. (2007). Top management championship is measured as a reflective scale covering top management beliefs and top management participation as per Liang et al. (2007). Innovation costs are operationalised using four items to assess perceived cost relative to benefits of initial investment, costs of training and integrating cloud computing with existing IT (Premkumar et al. 1994). The final control is employees' IT knowledge, operationalized using four items which will control for the differences between the organisation's ability to assimilate cloud computing (Liang et al. 2007).

Table 16 shows the control variables, questionnaire items and the primary sources of the items that were used to measure the defined controls.

Constructs	Variables	Questionnaire Items	Primary Source
Controls	Organisation size	Q5. Company Age (Years)	Liang et al. 2007
		Q6. Number of employees within the organisation	
		Q7. Number of IT staff within the organisation	
	Top management championship	Q53. The senior management in your firm believe that cloud computing has the potential to provide significant business benefits to the firm?	Liang et al. 2007
		Q54. The senior management in your firm believe that cloud computing will create a significant competitive arena for the firm?	
		Q55. The senior management in your firm believe that it is necessary to use cloud computing to conduct business activities?	
		Q56. The senior management in your firm actively articulate a vision for the organisational use of cloud computing?	
		Q57. The senior management in your firm actively formulate strategies for the organisational use of cloud computing?	
		Q58. The senior management in your firm establish goals and standards to	

Constructs	Variables	Questionnaire Items	Primary Source
		monitor cloud computing usage?	
	Innovation costs	Q59. The perceived benefits of cloud computing outweigh the costs of the initial investment?	Premkumar et al. 1994
		Q60. The perceived benefits of cloud computing outweigh the costs of staff training?	
		Q61. The perceived benefits of cloud computing outweigh the costs of integrating cloud computing services with existing hardware and software?	
		Q62. The perceived benefits of cloud computing outweigh the costs of integrating cloud computing with existing applications?	
	Employees' IT knowledge	Q49. Our IT staff have extensive experience in hardware and software?	Liang et al. 2007
		Q50. It is well known who within the IT team can help solve problems associated with cloud computing?	
		Q51. Our company can provide adequate technical support for using cloud computing?	
		Q52. Our company provides regular cloud computing training to its IT employees?	

Table 16: Controls - Constructs, Variables and Sources

A copy of the questionnaire can be found in APPENDIX C.

4.5 ETHICAL CONSIDERATIONS

Given the intention to survey individuals as key informants, it is necessary to consider ethical implications. In particular, three ethical considerations are identified, namely voluntary participation, informed consent, anonymity and confidentiality.

Firstly, potential respondents were invited to participate by completing a web-based survey. A cover letter (participant information sheet) provided details regarding the researcher and reasons for the research, the potential respondents were informed that participation is entirely voluntary and a consent section was included notifying the potential participant that completion of the survey assumes consent. The cover letter is contained in APPENDIX B.

Secondly, respondents were informed that there will be no risks or penalties or loss of benefits whether or not they participate. Respondents were able to withdraw at any stage in the research by exiting the survey.

Thirdly, responses are anonymous. Participants were not asked to provide any identifying information about themselves or their company. The respondent's name was not recorded anywhere and it is not possible to connect the respondent to the answers given.

Results are only reported in the aggregate. Raw data will not be provided to any other parties, and the data is being used for research purposes only. Responses are stored electronically in a secure, password protected database that is accessible only to the researcher and supervisor.

Ethics clearance was applied for and obtained from the university's human subject ethics committee (see APPENDIX A).

4.6 PRE-TEST AND PILOT STUDY

Prior to administration, the questionnaire was pre-tested and then pilot-tested. The purpose of the pre-test is to determine whether the questions used within the research instrument are possibly ambiguous, un-clear or present bias in wording (Bhattacherjee 2012).

Once the pre-test was concluded then a pilot study was administered. The pre-test was administered to a panel of experts, numbering five in total; the experts included both academics and practitioners who are au fait with cloud computing (in the case of practitioners) and technology adoption research (in the case of academics). Apart from improvements to the research instrument, the pre-test also aided in establishing content validity.

A pilot study was also undertaken, the pilot study was administered to a total of forty potential respondents with twelve respondents providing completed surveys responses. A pilot study involves administering the questionnaire to a small subset of respondents that are representative of the target population (Creswell 2009).

The purpose of this pilot study is to ensure face validity and that the measures used within the research instrument are reliable measures of the various institutional pressure variables and IS innovation characteristics variables. As a result of the pre-test and pilots test, it was identified that some of the instrument items needed to be revised, the following items were revised:

Initially the measures of Coercive pressures were drawn from Teo et al. (2003), after the pilot test a concern was identified with regards to validity of the measures relating to perceived dominance of suppliers and perceived dominance of customers. As a result it was decided to adapt the measures from Liang et al. (2007) to relate to market based pressures, the previous Section (4.4) references the amended items based on Liang et al. (2007). Table 17 shows the original measures and the measures subsequently used in the final instrument.

Original Items	**Final Items**
Perceived Dominance of Suppliers 1. My firm's well-being depends on their resources. 2. My firm cannot easily switch away from them. 3. My firm must maintain good relationships with them. 4. They are the core suppliers in a concentrated	**Perceived Dominance of Suppliers** 1. Our main suppliers require us to use cloud computing solutions (Q23). 2. Many of our transactions with suppliers can only be accomplished if we used cloud computing (Q25). 3. Our main suppliers that have adopted cloud computing are benefiting greatly? (Q30).

industry.	
Perceived Dominance of Customers: 1. My firm's well-being depends on their purchases 2. My firm cannot introduce switching costs to them 3. My firm MUST maintain good relationships with them 4. They are the largest customers in the industry	**Perceived Dominance of Customers:** 1. Our main customers require us to use cloud computing solutions (Q22). 2. Many of our transactions with customers can only be accomplished if we used cloud computing (Q24). 3. Our interactions with other businesses force us to use cloud computing (Q26). 4. Our main customers that have adopted cloud computing are benefiting greatly (Q33).

Table 17: Changes to Measures due to Pre-test and Pilot Test

Upon successful completion of the pilot study, the amended questionnaire was distributed to the remainder of the sample group.

4.7 VALIDITY AND RELIABILITY

Reliability and validity are foundational requirements for scientific research, especially in the social sciences. Reliability represents the extent to which the measures of a specified construct provide consistent and reproducible results. Validity represents the extent to which measures accurately represent the constructs they are intended to measure (Creswell 2009).

There are six generally recognised techniques that will be used to assess reliability: inter-rater reliability, test-retest reliability, split-half reliability or internal consistency reliability, and unidimensional reliability (Straub, Boudreau, and Gefen 2004). According to Mitchell 1985, internal consistency reliability provides an effective measure of consistency between different items of the same construct. Therefore, if a multiple-item construct measure is administered to respondents, and the respondents consistently rate those items in a similar manner, then this is a reflection of internal consistency. Given the relational nature of this study, internal consistency reliability will be measured using Cronbach's alpha, which is a commonly used estimation measure that assumes all items being considered for each construct are identically scored (Straub et al. 2004).

Convergent validity and discriminant validity are two key measures for assessing the validity of the applied measures. Convergent validity refers to the proximity with which a specified measure relates to the construct it is intended to measure. Discriminant validity meanwhile refers to the extent to which a specified measure does not measure constructs it is not intended to measure. In many cases both convergent validity and discriminant validity are jointly assessed for a related set of constructs (Mitchell 1985).

For the purposes of this study exploratory factor analysis technique, namely principal components analysis (PCA) was used to first confirm unidimensionality of the multi-item scales. PCA is a common statistical technique used to assess factor structures. Generally the norm for factor extraction is that extracted factors should have an eigenvalue greater than 1.0, this is applicable to this research. In order to demonstrate adequate unidimensionality all items should load high onto a single construct with a variance extracted above 60%.

Following this, Smart PLS is used to run a confirmatory factor analysis this is important to establishing convergent and discriminant validity. Convergent validity is demonstrated if the items belonging to a common construct and should exhibit factor loadings of 0.60 or higher on their expected theoretical construct (factor). Average variance extracted (AVE) for each construct should also be greater than .60. Furthermore, for discriminant validity items will have lower loadings on all other factors they are not intended to measure.

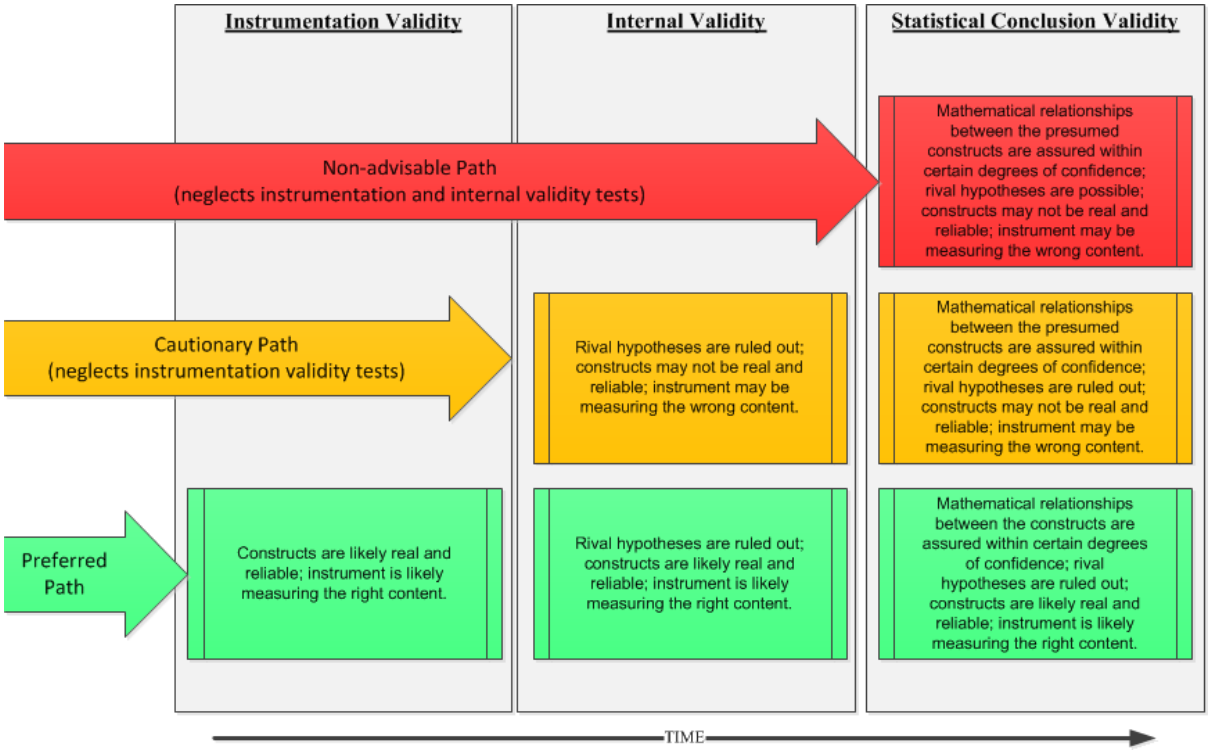

Figure 6: Validity Touchstones (Source: Straub 2004)

Table 18 summarizes the reliability and validity tests that were conducted and presented in Chapter 5.

Content validity	Use of pre-validated scales from the literature together with pre-test
Face validity	Pilot test
Unidimensionality	PCA loadings
Convergent validity	Confirmatory factor analysis in PLS with AVEs
Discriminant validity	Items should show high loadings in the CFA on their theoretical constructs and lower on other related constructs

Table 18: Validity and Reliability Tests

4.8 HYPOTHESIS TESTING

In order to analyse the existence and extent of association between the dependent and independent variables as represented by the hypotheses described in Chapter 3, correlation analyses will be carried out and presented using a correlation matrix. Thereafter, in order to explore the relative effects of

institutional pressures and control variables, as well as innovation characteristics and control variables, regression analyses will be carried out.

Finally, the hypotheses described in Chapter 3 will be tested using structural equation modelling (SEM); the specific technique used for SEM being partial least squares (PLS) approach. PLS allows for evaluation of the structural model variables. This approach is consistent with the hypothesis testing technique adopted by Teo et al. (2003). The technique estimates path coefficients in the model and the statistical significance of the paths (at an alpha level of 0.05) used as a basis for accepting or rejecting this study's hypotheses.

4.9 LIMITATIONS AND THREATS TO INTERNAL AND EXTERNAL VALIDITY

For the purposes of this study, cross-sectional field surveys were employed. The usage of field surveys enhances external validity since data was collected from respondents in a natural setting and the sample identified represents a known population (Cooper and Zmud 1990). However, any non-response or selection biases may affect external validity and limit the generalisability of the results. Hence, non-response bias is another limitation of survey research whereby low response rates raise concerns about systematic bias which might affect the generalisability of the results (Lee and Baskerville 2003).

Because of the non-temporal nature of field surveys, given that data on dependent and independent variables is collected at the same time, causality is difficult to infer from any observed correlations. Causal inferences can therefore only be made on the basis of theory. Furthermore field surveys may suffer from respondent biases whereby a respondent may provide a "socially desirable" response instead of their true response. Lastly, internal validity is compromised since it is impossible to control out all extraneous factors. All of these aforementioned factors negatively affect internal validity (Calder, Phillips, and Tybout 1982).

4.10 CHAPTER CONCLUSION

This chapter has detailed the research methodology applied by this study focusing on the survey method that was used, going into specifics of the research instrument used to operationalise the constructs by showing the constructs, variables and sources from which the items were selected. The importance of reliability and validity as foundational requirements of scientific research was also discussed as well as the techniques adopted by this research to assess reliability and validity of the constructs. The ethical considerations of gathering responses from respondents were covered and lastly the limitations of using field surveys and the effects of non-response or selection biases were outlined.

5 EMPIRICAL FINDINGS

5.1 INTRODUCTION

In this chapter, this study's findings are presented. This chapter commences with data screening for the purposes of identifying missing data and outlier analysis. Thereafter the response profile is presented, supplemented with a descriptive analysis of cloud computing adoption and then followed by tests for reliability and validity. The chapter then proceeds to present the results of correlation analyses, regression tests and results of the partial least squares analysis of the full structural model. The chapter concludes with a summarised presentation of the hypotheses that were supported and those that were rejected.

5.2 DATA CLEANING, MISSING DATA AND OUTLIERS

5.2.1 Data Screening

A total number of 980 potential respondents were identified and contacted in order to request their participation in this study. Altogether 121 responses were received over the duration of the data collection period, of the 121 participating respondents surveyed only 1 respondent opted not to participate by selecting 'No' in response to the question, "Do you agree to participate?" The remaining 120 respondents selected 'Yes'.

5.2.2 Missing Data

Missing data is an un-avoidable aspect of researcher independent data gathering. For this study there was a total of 120 responses, after removing the single respondent who opted not to participate.

These remaining 120 responses were screened to identify responses with large amounts of missing data where a large amount of missing data being the equivalent of more than 5 items of response data being omitted (in total the survey instrument comprised 61 questions). Of the 120 remaining responses, 33 were deleted since they contained more than 5 items of missing data. Thus, 87 full responses, containing either less than 5 items of missing data or no missing data, remained for further analysis.

Of the 87 responses a further 9 responses were missing less than 5 items of data. Table 19 presents the number of missing responses per survey question.

Question Number	Total Number of Missing Responses
Q19	1 Missing Response
Q 20	1 Missing Response
Q 23	1 Missing Response
Q 24	1 Missing Response
Q 25	1 Missing Response
Q 26	1 Missing Response
Q 31	2 Missing Responses
Q 33	1 Missing Response
Q 34	1 Missing Response
Q 36	2 Missing Responses

Question Number	Total Number of Missing Responses
Q 37	1 Missing Response
Q 38	1 Missing Response
Q 48	1 Missing Response
Q 60	1 Missing Response
Q 61	1 Missing Response
Q 62	2 Missing Responses

Table 19: Number of Missing Responses per Question

In Table 20 the 9 responses where less than 5 items of the data were missing are presented.

Number of Missing Items Overall	Number of Associated Respondents
1 Item	4 Responses Missing 1Item
2 Items	2 Responses Missing 2Items
3 Items	2 Responses Missing 3Items
5 Items	1 Response Missing 5Items

Table 20: Number of Missing Items and Number of associated Respondents

An examination of the missing data analysis presented in Table 19 and Table 20 does not reveal any underlying pattern as to why the 9 respondents with less than 5 items of missed data did not respond to some of the questions. As a result, the missing data was assumed to be missing at random and a mean substitution strategy was used to impute the missing responses.

5.2.3 Outlier Analysis

The remaining data was then screened to identify any univariate outliers, these outliers represent responses with unusually high or low values which may suggest the respondent is not from the same population as the other respondents. An effective method of detecting potential univariate outliers involves determining if any instances of each questionnaire item has a standardised score greater than +- 3. A standardised score greater than +- 3 represents observations that are 3 or more standard deviations away from the mean. Within a normal distribution 99.7% of all observations should fall within 3 standard deviations of the mean. Therefore respondents at the extreme tails of a distribution are potential outliers. A review of the standardised scores did not however reveal any extreme responses and no outliers are suspected. Therefore 87 responses remained to be used for meaningful statistical analysis.

5.3 RESPONSE PROFILE

The final sample consisted of 87 usable responses from 87 unique organisations. In this section the 87 responses will be profiled according to the respective demographic criteria used within the survey instrument: job title, years employed at the organisation, industry type, company age, number of employees, and number of IT staff. Number of employees and number of IT staff relate to the control measure of organisation size.

5.3.1 Respondents by Job Title

After profiling the respondent titles, it was found that the majority of the respondents, 69%, were senior IT decision-makers, with a total of 15% of the respondents having IT responsibilities albeit not formal IT titles, and the remaining 16% falling into a category of other (including e.g. finance director / manager). Table 21 shows the breakdown of the usable 87 responses according to respondent job title.

Job Titles	Number of Responses Per Job Title	Percentage of Total
IT Executive	21	24%
Other	14	16%
IT Manager	14	16%
CIO	12	14%
Technology Executive	7	8%
Technology Manager	6	7%
General Manager	6	7%
Operations Executive	4	5%
Operations Manager	3	3%

Table 21: Respondents by Job Title

5.3.2 Respondents by Years Employed at Organisation

Respondents with an excess of four years employment are very well represented, comprising 63% of the total sample; 21% between 4 to 8 years and 42% having more than 8 years employment at the organisation. The respondents having in excess of 2 years employment history at organisations are also well represented at 21% of the sample. Table 22 provides the breakdown of the number of responses based on the years employed at the organisation. Thus all respondents were considered appropriate key informants.

Years Employed	Number of Responses Per Years Employed	Percentage of Total
Less than 1	5	6%
1 to 2	9	10%
2 to 4	18	21%
4 to 8	18	21%
More than 8	37	42%

Table 22: Respondents by Years Employed at Organisation

5.3.3 Respondents by Industry

Respondents were asked to indicate within which industry their organisation can be classified. There was representation across industry types, with very high representation across other, financial services and technology respectively, these industries representing 66% of the total. Table 23 shows the respondents according to industry type.

Industry Type	Number of Responses Per Industry	Percentage of Total
Technology	23	26%
Financial Services and related	20	23%
Other[3]	15	17%
Manufacturing	8	9%
Telecommunications	6	7%
Retail	6	7%
Health	4	5%
Automotive and related	4	5%

Table 23: Respondents by Industry

5.3.4 Respondents by Company Age

Companies of various ages are represented in the sample with the vast majority (78%) being well established organisations at least 10 years or older and 32% being older than 30 years. Table 24 details the breakdown of the number of responses based on company age.

Company Age	Number of Responses Per Company Age	Percentage of Total
Less than 5	7	8%
5 to10	12	14%
10 to 20	28	32%
20 to 30	12	14%
More than 30	28	32%

Table 24: Respondents by Company Age

5.3.5 Respondents by Number of Employees

The number of employees is an item relating to the control measure of organisation size. All categories of the specified number of employees are represented in the sample, with companies having more than 2000 employees being the most represented at 38%. At the other end of the spectrum are organisations with less than 100 employees, comprising 22% of the total responses. Lastly, organisations with 500 to 1000 employees are the third most represented at 16%. Table 25 shows the number of responses per number of employees.

Number of Employees	Number of Responses Per Number of Employees	Percentage of Total
Less than 100	19	22%
100 to 300	8	9%
300 to 500	7	8%
500 to 1000	14	16%
1000 to 2000	6	7%
More than 2000	33	38%

Table 25: Respondents by Number of Employees

[3] Other includes industries such as: building, pharmaceuticals, food, mining, legal, logistics and wholesalers

5.3.6 Respondents by Number of IT Staff

The final item relating to the organisation size control is the number of IT staff. Organisations with less than 30 IT staff represent just over half of the total at 53%, with organisations having more than 200 IT staff representing 24% of the sample at the other end of the spectrum. Table 26 shows the number of responses according to the number of IT staff within the organisation.

Number of IT Staff	Number of Responses Per Number of IT Staff	Percentage of Total
Less than 10	28	32%
10 to 30	18	21%
30 to 50	8	9%
50 to 100	9	10%
100 to 200	3	4%
More than 200	21	24%

Table 26: Respondents by Number of IT Staff

5.3.7 Summary of Respondents' Demographics Profiling

In summary of the respondent's demographic characteristics it is evident that the sample for this study provides a balanced representation of the stated organisational sampling frame of medium to large South African organisations, this determination is made based on the percentages of the characteristics of company age, number of employees and number of IT staff.

The sample consists to a large extent of organisations greater than 2000 employees and older than 30 years. The sample also offers varied representation across numerous industry types which is in line with the information provided by the McGregors Who Owns Whom Directory. Lastly, two thirds of the respondents within the sample represent senior IT decision-makers and IT managers within their respective organisations; this is very much in line with the stated objective of targeting these individuals given their understanding of their organisation's current and future IT plan.

5.4 DESCRIPTIVE SUMMARY OF CLOUD COMPUTING ADOPTION

Through this study some of the data gathered presents an opportunity to glean a better understanding of the extent of cloud computing adoption across the cloud service models of IaaS, PaaS and SaaS. In this section the extent of adoption of IaaS, PaaS, SaaS, and None (no adoption) is assessed in light of the demographic data gathered.

Table 27 details the percentage of adoption of SaaS, PaaS, and IaaS based on industry type as reflected in the sample of 87 responses. Across the sample it was discovered that adoption of SaaS, PaaS, and IaaS appears to be well diffused within the automotive and related, financial services, technology, and telecommunications industries; and furthermore within these industries IaaS appears to be the most diffused, followed by SaaS, and lastly PaaS.

Across the sample responses it can be observed that of the cloud computing service models SaaS (50.6%) is the most diffused, followed by IaaS (44.8%), and it is apparent that to date PaaS (29.9%) is the least adopted cloud service model across industries.

Based on this sample it is evident that diffusion of cloud computing is occurring across industries, albeit that not all industries are adopting IaaS, SaaS and PaaS at the same rate.

Demographic Characteristic	Demographic Group	Cloud Computing Service Model			
		SaaS	PaaS	IaaS	None
Industry	Automotive and related	75.0%	25.0%	100.0%	0.0%
	Financial Services and related	50.0%	15.0%	35.0%	40.0%
	Food	0.0%	0.0%	0.0%	100%
	Health	0.0%	0.0%	50.0%	50.0%
	Manufacturing	50.0%	0.0%	37.5%	0.0%
	Other	26.7%	20.0%	20.0%	60.0%
	Retail	100.0%	16.7%	0.0%	0.0%
	Technology	69.6%	56.5%	65.2%	17.4%
	Telecommunications	16.7%	33.3%	83.3%	16.7%
Total		**50.6%**	**29.9%**	**44.8%**	**28.7%**

Table 27: Cloud Computing Adoption Based on Industry

Table 28 shows the adoption of SaaS, PaaS, and IaaS based on company age. Some of the findings from this analysis of the sample indicate that companies older than 30 years are far less likely to have adopted cloud computing (42.9% no adoption) than companies less than 5 years old (only 14.3% no adoption). Another finding is that companies aged 5 to 10 are far more likely to have adopted SaaS, with 66.7% of the respondents in this group having adopted SaaS. Similarly companies aged 10 to 20 years have predominantly adopted IaaS at 60.7%, however adoption of SaaS (50%) and PaaS (42.9%) indicates that cloud computing diffusion in this group is fairly evenly distributed.

Demographic Characteristic	Demographic Group	Cloud Computing Service Model			
		SaaS	PaaS	IaaS	None
Company Age	Less than 5	57.1%	28.6%	42.9%	14.3%
	5 to10	66.7%	16.7%	33.3%	33.3%
	10 to 20	50.0%	42.9%	60.7%	14.3%
	20 to 30	41.7%	16.7%	41.7%	33.3%
	More than 30	46.4%	28.6%	35.7%	42.9%
Total		**50.6%**	**29.9%**	**44.8%**	**28.7%**

Table 28: Cloud Computing Adoption Based on Company Age

In Table 29 the adoption of cloud computing is assessed based on the number of employees. In this table it is observed that organisations with up to 300 employees have the most extensive diffusion of IaaS (83.3%). The percentage of the sample that have not adopted any form of cloud computing is fairly evenly distributed for organisations with employees ranging from 300 to more than 2000.

Smaller to medium sized organisations are far more likely to have some form of cloud computing in place than larger companies.

Demographic Characteristic	Demographic Group	Cloud Computing Service Model			
		SaaS	PaaS	IaaS	None
Number of Employees	Less than 100	62.5%	37.5%	25.0%	0.0%
	100 to 300	33.3%	50.0%	83.3%	0.0%
	300 to 500	28.6%	14.3%	42.9%	28.6%
	500 to 1000	50.0%	7.1%	28.6%	35.7%
	1000 to 2000	57.9%	26.3%	42.1%	36.8%
	More than 2000	51.5%	39.4%	51.5%	33.3%
Total		**50.6%**	**29.9%**	**44.8%**	**28.7%**

Table 29: Cloud Computing Adoption Based on Number of Employees

Table 30 shows the extent of adoption of IaaS, PaaS and SaaS across the sample based on the number of IT staff. From this table it is observed that two thirds (66.7%) of companies with 10 to 30 and 50 to 100 IT staff have adopted IaaS already, followed by companies having more than 200 IT staff that have adopted IaaS at a rate of 57.1%. It is also observed across the IT staff demographic groups that both IaaS and SaaS have diffused more than PaaS. Lastly, the number of organisations that have not adopted cloud computing is observed to be the same across companies with less than 10 and more than 200 IT staff at 33.3%. Based on the sample it appears that organisations with IT staff over 50 are more likely to have adopted PaaS and IaaS, but SaaS adoption appears un-related to size. It also appears that organisations with up to 100 IT staff and organisations with more than 200 IT staff have the most extensively diffused adoption across SaaS, PaaS, and IaaS, with IaaS being the most diffused of the three cloud service models across this group.

Demographic Characteristic	Demographic Group	Cloud Computing Service Model			
		SaaS	PaaS	IaaS	None
Number of IT Staff	Less than 10	50.0%	16.7%	44.4%	33.3%
	10 to 30	33.3%	0.0%	66.7%	0.0%
	30 to 50	50.0%	12.5%	25.0%	37.5%
	50 to 100	44.4%	44.4%	66.7%	22.2%
	100 to 200	57.1%	32.1%	32.1%	25.0%
	More than 200	47.6%	42.9%	57.1%	33.3%
Total		**50.6%**	**29.9%**	**44.8%**	**28.7%**

Table 30: Cloud Computing Adoption Based on Number of IT Staff

The following was discovered across the sample: cloud computing in the form of IaaS, SaaS, and PaaS has diffused across industries and organisations of varying size with just under one third of respondents (28.7%) not having adopted any form of cloud computing. For those organisations that have adopted cloud computing it was found that SaaS has been adopted by just over half the

respondents at 50.6%, with IaaS a close second at 44.8% adoption and PaaS somewhat lagging at 29.9%. Therefore, it is observed that the diffusion of cloud computing is in progress but there is still some way to go before cloud computing realises complete broad-based diffusion across industries and organisations of different sizes.

This chapter next turns its attention towards understanding the factors influencing variations in the adoption of cloud computing as hypothesized in Chapter 3.

5.5 MEASUREMENT AND STRUCTURAL MODEL

Prior to testing the hypotheses of institutional and DOI factors influencing cloud adoption, it is necessary to first confirm the reliability and validity of the measures. Figure 7 depicts this study's measurement and structural model. Depicted in the measurement model are four separate groupings: the first group includes the institutional pressure items, the second group the Diffusion of Innovation Theory items, the third group covers the control items and lastly, the fourth group covers the adoption (dependent variable) items. The specifics of these convergent validity and discriminant validity examinations of these groupings are covered in Section 5.6.

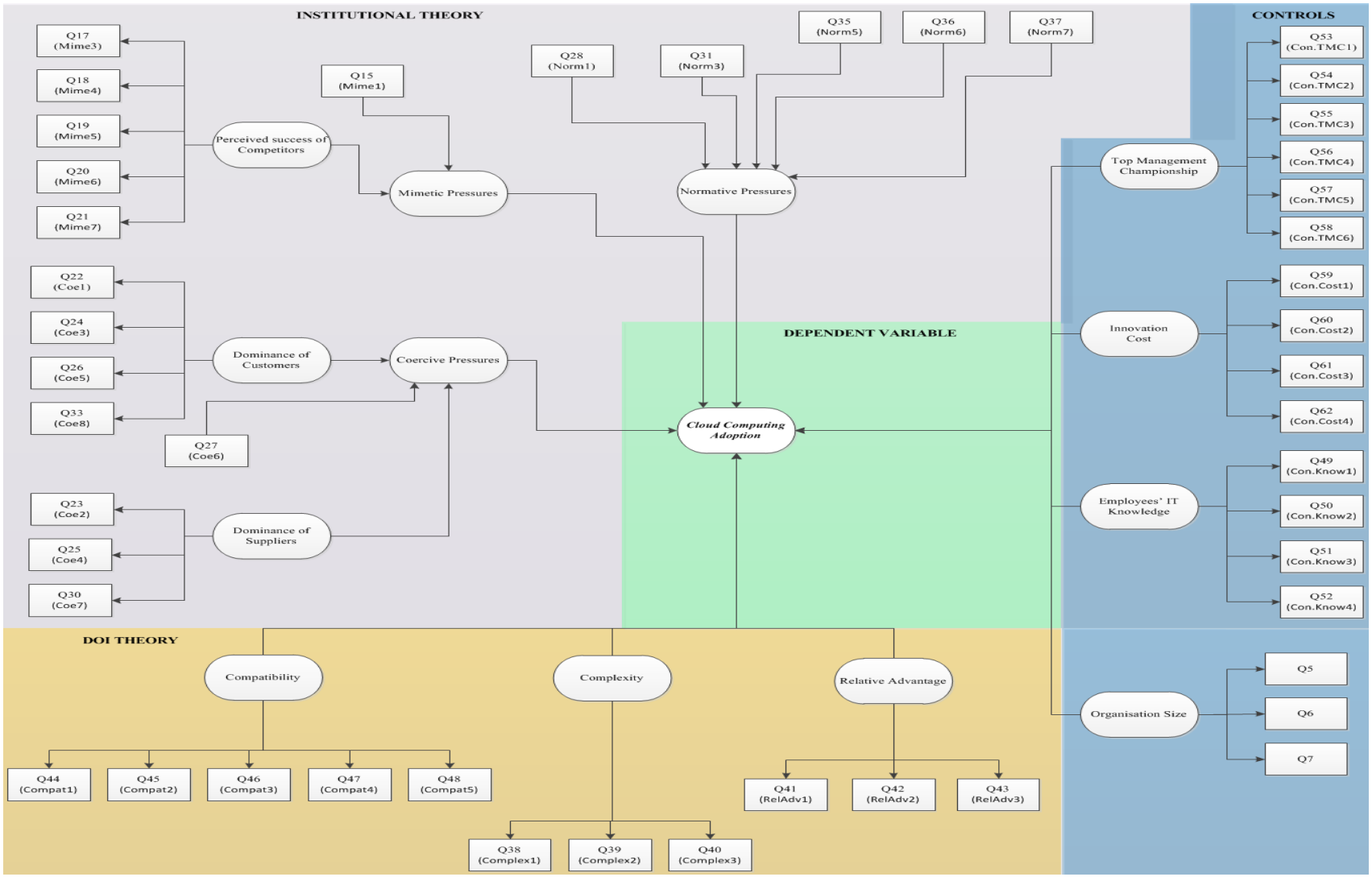

Figure 7: Measurement and Structural Model

5.6 RELIABILITY AND VALIDITY OF THE MEASUREMENT MODEL

5.6.1 Validity Measurement

In order to assess convergent validity and discriminant validity of the items drawn respectively from the institutional pressures, innovation characteristics, cloud adoption and control variables, it was necessary to first establish unidimensionality of the scales by conducting exploratory factor analysis. The method adopted was principal component analysis (PCA), which can be used to assess the underlying unidimensionality of the multi-item scales. This is achieved by identifying whether a variable's measurement items all load highly onto a single component

Next, confirmatory factors analysis was used to establish convergent validity, which demonstrates whether all items measuring a construct load higher onto the intended theoretical construct and lower on constructs it is not intended to measure. AVEs should also be in excess of .60 indicating that a construct can account for more than 60% of the variance in its underlying measures.

For the mimetic institutional pressures an analysis was performed on the 5 items relating to the perceived success of competitors; in addition, for the analysis of the coercive institutional pressures there were 4 items for the dominance of customers and 3 items for the dominance of suppliers. For the innovation characteristics the analysis covered 5 items for compatibility, 3 items for complexity and 3 items for relative advantage. Lastly, for the control variables the analysis covered 6 items pertaining to top management championship, 4 items relating to innovation cost and finally, 4 items relating to employees' IT knowledge.

The following sections present the results of the validity tests for each of the constructs

5.6.1.1 Institutional Pressures

PCA analysis confirmed the unidimensionality of the multi-item institutional pressure scales. Specifically undimensionality was confirmed for the perceived success of competitors with cloud computing adoption (mimetic pressures) reflected in Table 31, dominance of suppliers (coercive pressures) in Table 32, and dominance of customers (coercive pressures) shown in Table 33.

	Component
	1
Mime3	.875
Mime4	.909
Mime5	.867
Mime6	.868
Mime7	.758

Table 31: PCA of Mimetic Pressures – Perceived Success of Competitors

	Component
	1
Coe2	.885
Coe4	.853
Coe7	.698

Table 32: PCA of Coercive Pressures – Dominance of Suppliers

	Component
	1
Coe1	.846
Coe3	.844
Coe5	.848
Coe8	.751

Table 33: PCA of Coercive Pressures – Dominance of Customers

A CFA analysis within SmartPLS was then carried out in order to further test the convergent validity of these scales. This was conducted together with the Adoption construct. This test resulted in Table 34, a loadings matrix for the institutional scales (standardised loadings are shown):

	Mimetic	Coercive - Suppliers	Coercive - Customers	Adoption
Mime3	**0.8683**	0.7324	0.6648	0.4717
Mime4	**0.9092**	0.6515	0.6418	0.5482
Mime5	**0.8569**	0.6762	0.6603	0.4459
Mime6	**0.8681**	0.6293	0.6674	0.5581
Mime7	**0.7741**	0.6524	0.6604	0.5283
Coe2	0.638	**0.8598**	0.749	0.4055
Coe4	0.5395	**0.8053**	0.7262	0.3338
Coe7	0.6951	**0.7686**	0.5694	0.4334
Coe1	0.5629	0.6336	**0.8188**	0.39
Coe3	0.5345	0.6863	**0.8055**	0.3993
Coe5	0.7237	0.7605	**0.8507**	0.4539
Coe8	0.6725	0.6555	**0.8061**	0.5657
Adop2	0.5683	0.3584	0.4548	**0.7674**
Adop3	0.4496	0.4491	0.4732	**0.7703**
Adop4	0.4457	0.4932	0.5206	**0.722**
Adop5	0.4493	0.2946	0.3713	**0.8524**
Adop6	0.4727	0.323	0.4229	**0.8496**
Adop7	0.4532	0.4043	0.4373	**0.8007**
AVE	**0.7336**	**0.6595**	**0.6732**	**0.6322**

Table 34: Institutional Scales Loadings Matrix

	Mimetic	Coercive - Suppliers	Coercive - Customers	Adoption
Mimetic	0.856505			
Coercive - Suppliers	0.7785	0.812096		
Coercive - Customers	0.7699	0.8341	0.820488	
Adoption	0.6011	0.4878	0.5647	0.79511

Table 35: Correlations Amongst the Factors with Square Root of AVE on Diagonal

From Table 34 it can be observed that the AVEs are all well above .60 thus demonstrating convergent validity. From Table 34 it can also be observed that the individual item loadings were all higher on the theoretical constructs they are intended to reflect and lower on the other items. Thus adding to confirmation of convergent and discriminant validity.

The institutional pressures measured via single items are not included in this analysis. They are not expected to covary and therefore not expected to load onto a single construct. They are examined for their effects on adoption in the overall model testing in subsequent sections.

5.6.1.2 DOI Characteristics

PCA analysis confirmed the unidimensionality of the multi-item DOI scales. Specifically undimensionality was confirmed for compatibility reflected in Table 36, relative advantage in Table 37, and complexity shown in Table 38.

The first run of the analysis suggested that Compat1 should drop and it was therefore excluded from the compatibility scale. The final result of the PCA analysis is presented below.

	Component
	1
Compat2	.852
Compat3	.872
Compat4	.843
Compat5	.859

Table 36: PCA of Compatibility (Excluding Compat1)

	Component
	1
RelAdv1	.870
RelAdv2	.908
RelAdv3	.814

Table 37: PCA of Relative Advantage

	Component
	1
Complex1	.879
Complex2	.879
Complex3	.902

Table 38: PCA of Complexity

Table 39 presents the results of the CFA analysis within SmartPLS that was carried out on the DOI scales. The results are presented as a loadings matrix for the DOI scales (standardised loadings are shown). . The analysis included the Adoption scale:

	Adoption	Compatibility	Complexity	Relative Advantage
Adop2	**0.7464**	0.5292	-0.0533	0.3987
Adop3	**0.7394**	0.295	-0.0765	0.3836
Adop4	**0.7053**	0.3299	-0.15	0.5034
Adop5	**0.8701**	0.4713	-0.2853	0.4839
Adop6	**0.8711**	0.4951	-0.2745	0.4715
Adop7	**0.8256**	0.5259	-0.3159	0.4465
Compat2	0.3936	**0.8228**	-0.4043	0.4134
Compat3	0.3931	**0.846**	-0.311	0.2297
Compat4	0.5943	**0.8763**	-0.1923	0.4726
Compat5	0.4965	**0.8696**	-0.2802	0.349
Complex1	-0.0959	-0.1715	**0.8182**	-0.1882
Complex2	-0.0449	-0.167	**0.7754**	-0.1751
Complex3	-0.304	-0.3704	**0.9786**	-0.274
RelAdv1	0.4797	0.4304	-0.1872	**0.8718**
RelAdv2	0.5536	0.3845	-0.2912	**0.918**
RelAdv3	0.4179	0.3227	-0.2014	**0.8003**
AVE	**0.6331**	**0.7292**	**0.7428**	**0.7478**

Table 39: DOI Scales Loadings Matrix

	Adoption	Compatibility	Complexity	Relative Advantage
Adoption	0.795676			
Compatibility	0.5651	0.853932		
Complexity	-0.2522	-0.3324	0.861858	
Relative Advantage	0.5641	0.4395	-0.2658	0.864754

Table 40: Correlations Amongst the Factors with Square Root of AVE on Diagonal

From Table 39 it can be observed that the AVEs are all well above .60 thus demonstrating convergent validity. From Table 39 it can also be observed that the individual item loadings were all higher on the theoretical constructs they are intended to reflect and lower on the other items. This adds to confirmation of convergent and discriminant validity.

5.6.1.3 Controls

PCA analysis confirmed the unidimensionality of the multi-item organisational factors used as controls. Undimensionality was confirmed for innovation cost as shown in Table 41, top management championship in Table 42, and employees' IT knowledge shown in Table 43.

The first run of the analysis suggested that Con.Know4 should drop and it was therefore excluded from the knowledge scale. The final result of the PCA analysis is presented below.

	Component
	1
Con.Cost1	.845
Con.Cost2	.911
Con.Cost3	.884
Con.Cost4	.821

Table 41: PCA of Innovation Cost

	Component
	1
Con.TMC1	.909
Con.TMC2	.865
Con.TMC3	.893
Con.TMC4	.942
Con.TMC5	.945
Con.TMC6	.871

Table 42: PCA of Top Management Championship

	Component
	1
Con.Know1	.691
Con.Know2	.896
Con.Know3	.901

Table 43: PCA of Employees' IT Knowledge (Excluding Con.Know4)

Table 44 presents the results of the CFA analysis within SmartPLS that was carried out in order to further test the convergent validity of these scales. The results are presented as a loadings matrix for the control scales (standardised loadings are shown):

	Adoption	Control – Innovation Cost	Control – Employees' IT Knowledge	Control – Top Management Championship
Adop2	**0.7509**	0.4324	0.4676	0.6408
Adop3	**0.7652**	0.2726	0.3918	0.6474
Adop4	**0.704**	0.297	0.3482	0.5366
Adop5	**0.863**	0.3313	0.4572	0.6587
Adop6	**0.8619**	0.3923	0.4204	0.6678
Adop7	**0.8174**	0.3792	0.4231	0.6648
Con.Cost1	0.3489	**0.8327**	0.4623	0.4349
Con.Cost2	0.3734	**0.896**	0.4041	0.469
Con.Cost3	0.3624	**0.8853**	0.3629	0.477
Con.Cost4	0.434	**0.8458**	0.5034	0.4819
Con.Know1	0.2957	0.2129	**0.7151**	0.2513
Con.Know2	0.4903	0.4361	**0.925**	0.5917

Con.Know3	0.5259	0.573	**0.9151**	0.6117
Con.TMC1	0.7512	0.4651	0.5973	**0.9102**
Con.TMC2	0.7343	0.3267	0.4887	**0.8682**
Con.TMC3	0.6893	0.5486	0.4316	**0.8916**
Con.TMC4	0.7456	0.5003	0.5716	**0.9416**
Con.TMC5	0.7352	0.527	0.5436	**0.9442**
Con.TMC6	0.6938	0.5718	0.6122	**0.8696**
AVE	**0.6334**	**0.7489**	**0.7348**	**0.8186**

Table 44: Control Scales Loadings Matrix

	Adoption	**Control – Innovation Cost**	**Control – Employees' IT Knowledge**	**Control – Top Management Championship**
Adoption	0.795864			
Control – Innovation Cost	0.4424	0.86539		
Control – Employees' IT Knowledge	0.5273	0.5043	0.857205	
Control – Top Management Championship	0.802	0.5399	0.5986	0.904765

Table 45: Correlations Amongst the Factors with Square Root of AVE on Diagonal

From Table 44 it can be observed that the AVEs are all well above .60 thus demonstrating convergent validity. From Table 44 it can be observed that the individual item loadings were all higher on the theoretical constructs they are intended to reflect and lower on the other items. Thus adding to confirmation of convergent and discriminant validity.

5.6.1.4 Adoption of Cloud Computing (Dependent Variable)

From Table 46 it can be observed that the PCA of adoption reveals that all the adoption items load highly onto component 1, hence all will be retained since unidimensionality and convergent validity are demonstrated. Adop1 was not included in the PCA given that Adop1 was a descriptive item.

	Component
	1
Adop2	.742
Adop3	.758
Adop4	.707
Adop5	.867
Adop6	.867
Adop7	.821

Table 46: PCA of Adoption

Moreover, the CFA analyses illustrated above (Table 34, Table 39, and Table 44), show that adoption is adequately discriminated as a construct from the institutional and DOI variables as well as the organisational control variables intended to predict it.

5.6.2 Reliability Measurement - Cronbach's Alpha

In order to assess reliability, Cronbach's alpha was utilised as a test of the internal consistency of the scales. Using Cronbach's alpha, evidence of acceptable scale reliability is achieved with results above 0.7. Furthermore, it is also useful to examine variable-to-total correlations, which are generally acceptable when above 0.4.

Table 47 presents the results of the reliability tests for each of the variables.

Variables	Number of Surviving Items	Cronbach's Alpha	Mean	Std. Deviation	Skewness	Kurtosis
Cloud Computing Adoption	6	.882	3.032	.193	-.109	-.763
Perceived Success of Competitors (Mimetic variables)	5	.894	3.168	.009	-.507	.149
Dominance of Customers (Coercive Variables)	4	.840	2.682	.172	.043	-.676
Dominance of Suppliers (Coercive variables)	3	.748	2.712	.208	.173	-.314
Relative Advantage	3	.826	3.805	.026	-.343	-.400
Compatibility	4	.877	3.444	.015	.549	-.292
Complexity	3	.863	2.419	.043	-.898	1.198
Top Management Championship (Control)	6	.955	3.188	.036	-.381	-.569
Innovation Cost (Control)	4	.884	3.476	.012	-.152	.385
Employees' IT Knowledge (Control)	3	.819	3.843	.091	-.619	.816

Table 47: Reliability Using Cronbach's Alpha

A cut-off value of 0.7 was used for Cronbach's alpha in order to examine the reliability of the variables. The items dropped after PCA, namely Compat1 and Con.Know4 were not included. Hence, the multi-item scales all revealed good reliability (internal consistency) with all alpha values above the generally accepted 0.7 cut-off level. Given that the normative variables will be modelled in the formative mode, these variables are not included in this reliability assessment. As a general rule for interpreting skewness and kurtosis respectively, skewness should lie between ± 1 and kurtosis between ± 3. Hence, the variables reflected in Table 35 fall within acceptable levels and appear to have distributions that are not too highly skewed. .

5.6.3 Correlation Analysis

For the purposes of conducting the correlation analysis composite scores were determined for the multi-item scales; namely, cloud computing adoption, perceived success of competitors, dominance of customers, dominance of suppliers, compatibility, complexity, relative advantage, top management championship, innovation cost, and employees' IT knowledge. Single items were retained for the normative pressures, Mime 1 was a single item reflecting the extent of cloud computing adoption amongst competitors and Coe6 was a single item reflecting whether a parent organisation requires the usage of cloud computing. The variables of company age, number of company employees and number of IT employees are also included.

Table 48 provides an overall correlation matrix of the eleven independent variables drawn from Institutional Theory and DOI: the extent of adoption by competitors, the perceived success of adoption by competitors, perceived dominance of supplier adopters, perceived dominance of customer adopters, conformity with the parent corporation, extent of adoption by organisation's suppliers, extent of adoption by organisation's customers, participation in professional, trade and business bodies, relative advantage, complexity, and compatibility. Also included in Table 48 are the four control variables: organisation size, top management championship, innovation cost, and employees' IT knowledge. Finally, the dependent variable, cloud computing adoption is included.

Norm2 and Norm4 are not included in Table 48 since these items are descriptive in nature and used to better understand what cloud computing service models were adopted by suppliers and customers respectively.

	Con.CompanyAge	Con.NumberEmployees	Con.NumberITStaff	Coe6	Norm7	Norm1	Norm3	Norm5	Norm6	Mime1	CompositeAdoption	Composite SuccessofCompetitors	Composite DominanceofCustomers	CompositeDominanceofSuppliers	CompositeCompatibility	CompositeComplexity	CompositeRelAdvantage	CompositeControlTMC	CompositeControlCost	CompositeControlKnowledge
Con.CompanyAge	1																			
Con.NumberEmployees	.617**	1																		
Con.NumberITStaff	.475**	.787**	1																	
Coe6	-.031	-.143	-.024	1																
Norm7	-.010	.115	-.005	-.248*	1															
Norm1	.044	.208	.271*	.063	.049	1														
Norm3	.058	.125	.113	.019	.099	.527**	1													
Norm5	.048	.198	.214*	-.125	.178	.234*	.381**	1												
Norm6	-.036	.152	.209	-.049	.102	.451**	.426**	.340**	1											
Mime1	-.031	.047	.107	.061	-.082	.546**	.599**	.161	.388**	1										
CompositeAdoption	**-.076**	**.066**	**.114**	**.133**	**.016**	**.415****	**.440****	**.259***	**.483****	**.514****	**1**									
Composite SuccessofCompetitors	.031	.217*	.185	-.046	.024	.448**	.504**	.352**	.553**	.488**	**.598****	1								
Composite DominanceofCustomers	-.025	.114	.106	.124	-.094	.428**	.620**	.407**	.465**	.517**	**.537****	.757**	1							
CompositeDominanceofSuppliers	.083	.226*	.211*	.141	-.086	.440**	.511**	.387**	.479**	.410**	**.471****	.759**	.846**	1						
CompositeCompatibility	-.112	.041	.047	.030	.024	.218*	.245*	.251*	.267*	.259*	**.544****	.457**	.335**	.285**	1					
CompositeComplexity	.193	.046	.109	.067	-.266*	.046	.015	-.112	.018	.092	**-.155**	.074	.102	.173	-.272*	1				
CompositeRelAdvantage	-.128	.122	.086	.018	.112	.247*	.293**	.287**	.487**	.328**	**.556****	.402**	.441**	.359**	.434**	-.235*	1			
CompositeControlTMC	-.082	.070	.138	.185	.107	.426**	.439**	.240*	.531**	.456**	**.800****	.571**	.539**	.437**	.615**	-.190	.658**	1		
CompositeControlCost	-.133	.205	.269*	.054	-.028	.145	.149	.233*	.288**	.194	**.443****	.463**	.360**	.322**	.562**	-.261*	.492**	.543**	1	
CompositeControlKnowledge	-.065	.164	.257*	.130	.121	.274*	.161	.206	.331**	.229*	**.523****	.293**	.257*	.141	.532**	-.296**	.435**	.589**	.496**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 48: Pearson Correlations Between Variables

From Table 48 it is apparent that most of the independent variables drawn from Institutional Theory and DOI, and the internal organisational control variables correlate to adoption. However, Norm7 which is drawn from Institutional Theory does not correlate to adoption, and Complexity which is drawn from DOI does not correlate to the dependent variable. Also, age and organisation size variables do not have a significant correlation to adoption. Lastly, a key observation is that the control variable for top management championship has a very high correlation indicating its potential significance of this internal organisational factor.

Given the number of statistically significant correlations that were observed between adoption and the various independent variables drawn from Institutional Theory and DOI, it would be useful to consider their combined and relative effects via regression analysis. In the next section regression analysis is used to explore the combined effects of the Institutional Theory, DOI, and control variables on adoption.

5.6.4 Regression Analysis

5.6.4.1 Institutional Theory and DOI Regression Analysis

A regression analysis was first conducted to regress the dependent adoption variable on the Institutional Theory variables. Table 49 shows the regression analysis summary output for the Institutional Theory variables.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.616[a]	.380	.357	.83444
a. Predictors: (Constant), CompositeDominanceofSuppliers, CompositeSuccessofCompetitors, CompositeDominanceofCustomers				

Table 49: Institutional Theory Regression Analysis

From Table 49 it is evident that the Institutional Theory factors are important, with an Adjusted R-squared of .380, hence explaining 38% of the variance.

Next, a regression analysis was conducted to regress the dependent adoption variable on the DOI variables. This regression analysis on the DOI variables is shown in Table 50.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.651[a]	.424	.404	.80398
a. Predictors: (Constant), CompositeRelAdvantage, CompositeComplexity, CompositeCompatibility				

Table 50: DOI Regression Analysis

Table 50 shows that the DOI factors are also important, with an Adjusted R-squared of .404, hence explaining 40% of the variance.

5.6.4.2 Hierarchical Regression Analysis

Hierarchical regression analysis was then used to regress the dependent adoption variable on all the independent variables. The first block of the hierarchical regression entered the control variables (organisation size, top management championship, innovation cost, and employees' IT knowledge). The second block entered the Institutional Theory variables (mimetic pressures, coercive pressures, and normative pressures). The third block entered the DOI variables (compatibility, complexity, and relative advantage). The objective of the hierarchical regression technique is to determine the contribution that each block of independent variables makes on the dependent variable above and beyond the first regression block of independent variables. The advantage of using hierarchical regression is that it allows for the change in R-squared to be evaluated and therefore to determine whether the sequential introduction of the blocks aid in the explanation of variance.

In Table 51, Table 52, and Table 53 respectively the control variables are reflected as Model 1. The control variables along with the DOI variables are reflected as Model 2, and Model 3 reflects the control variables, DOI variables and the Institutional Theory variables.

In Table 51 the important measure is the Adjusted R Square value, this value indicates the percentage of variance for which the model accounts. Therefore, Model 1 accounts for 69% of the variance, Model 2 for 68% and Model 3 for 70% of the variance. Thus, increasing the number of variables in the model does not add significantly to the R Square.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.842[a]	.709	**.692**	.60052	.709	40.695	3	50	.000
2	.850[b]	.722	**.686**	.60589	.013	.706	3	47	.553
3	.890[c]	.792	**.709**	.58340	.070	1.410	9	38	.218

a) Predictors: (Constant), CompositeControlKnowledge, CompositeControlCost, CompositeControlTMC
b) Predictors: (Constant), CompositeControlKnowledge, CompositeControlCost, CompositeControlTMC, CompositeComplexity, CompositeRelAdvantage, CompositeCompatibility
c) Predictors: (Constant), CompositeControlKnowledge, CompositeControlCost, CompositeControlTMC, CompositeComplexity, CompositeRelAdvantage, CompositeCompatibility, Coe6, Norm5, Norm7, Norm1, Mime1, CompositeDominanceofSuppliers, Norm6, Norm3, CompositeSuccessofCompetitors, CompositeDominanceofCustomers

Table 51: Model Summary

Table 52 shows the ANOVA, which assesses the overall significance of the respective models. If the value of Sig. (p) is < 0.05, then the model is significant. Hence, all three models are significant since the p value is <0.05.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.027	3	14.676	40.695	**.000**[b]
	Residual	18.031	50	.361		
	Total	62.058	53			
2	Regression	44.804	6	7.467	20.342	**.000**[c]
	Residual	17.254	47	.367		
	Total	62.058	53			
3	Regression	49.125	15	3.275	9.622	**.000**[d]
	Residual	12.933	38	.340		
	Total	62.058	53			

a) Dependent Variable: CompositeAdoption
b) Predictors: (Constant), CompositeControlKnowledge, CompositeControlCost, CompositeControlTMC
c) Predictors: (Constant), CompositeControlKnowledge, CompositeControlCost, CompositeControlTMC, CompositeComplexity, CompositeRelAdvantage, CompositeCompatibility
d) Predictors: (Constant), CompositeControlKnowledge, CompositeControlCost, CompositeControlTMC, CompositeComplexity, CompositeRelAdvantage, CompositeCompatibility, Coe6, Norm5, Norm7, Norm1, Mime1, CompositeDominanceofSuppliers,Norm6, Norm3, CompositeSuccessofCompetitors, CompositeDominanceofCustomers

Table 52: ANOVA

Lastly in Table 53 the standardised beta coefficients are indicated, these values give a measure of the contribution of each variable to Model 1, Model 2, and Model 3 respectively. Furthermore the t and p values provide a rough indication of the impact of each variable. Therefore, in Model 3 it is apparent that innovation cost, dominance of customers, dominance of suppliers, and Norm7 provide very little contribution to the dependent variable.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.492	.428		1.149	.256
	CompositeControlTMC	.841	.101	**.851**	8.326	.000
	CompositeControlCost	-.071	.122	**-.054**	-.579	.565
	CompositeControlKnowledge	.039	.128	**.030**	.306	.761
2	(Constant)	-.097	.684		-.142	.888
	CompositeControlTMC	.808	.116	**.817**	6.974	.000
	CompositeControlCost	-.087	.132	**-.066**	-.656	.515
	CompositeControlKnowledge	.060	.135	**.047**	.444	.659
	CompositeCompatibility	.138	.131	**.102**	1.049	.299
	CompositeComplexity	.107	.103	**.087**	1.033	.307
	CompositeRelAdvantage	-.013	.135	**-.010**	-.097	.923

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
3	(Constant)	-.352	.834		-.423	.675
	CompositeControlTMC	.511	.148	**.517**	3.445	.001
	CompositeControlCost	-.148	.135	**-.113**	-1.101	.278
	CompositeControlKnowledge	.161	.146	**.126**	1.104	.277
	CompositeCompatibility	.069	.140	**.052**	.496	.622
	CompositeComplexity	.078	.114	**.063**	.682	.499
	CompositeRelAdvantage	.056	.138	**.042**	.407	.687
	CompositeSuccessofCompetitors	.305	.233	**.222**	1.310	.198
	CompositeDominanceofCustomers	-.058	.189	**-.046**	-.304	.763
	CompositeDominanceofSuppliers	-.012	.195	**-.010**	-.064	.950
	Norm1	.175	.139	**.130**	1.262	.214
	Norm3	.118	.152	**.082**	.779	.441
	Norm5	-.069	.164	**-.039**	-.421	.676
	Norm6	.041	.096	**.044**	.430	.670
	Mime1	.194	.129	**.142**	1.504	.137
	Coe6	.348	.262	**.145**	1.329	.192
	Norm7	-.397	.247	**-.138**	-1.612	.115
a. Dependent Variable: CompositeAdoption						

Table 53: Regression coefficients for the Hierarchical Regression Analysis

Through the regression analysis of the Institutional Theory and DOI variables respectively, it was discovered that both the Institutional Theory and DOI variables were important in explaining variance. However, after running the hierarchical regression analysis and extracting the Adjusted R-squared it was discovered that model 1 accounts for 69% of the variance, and the inclusion of model 2 (68%) and model 3 (70%) thereafter, are not a big improvement over Model 1. It is therefore concluded that the control variables, with a specific focus on top management championship, may be mediating the effects of the other factors.

The next stage of analysis involves the modelling of the mimetic pressures, coercive pressures, and normative pressures as higher-order factors as per the research model. Therefore, a structured equation modelling (SEM) technique was required. Specifically, the partial least squares (PLS) approach to SEM was used. SmartPLS software version 2.0 was used (http://www.smartpls.de/).

5.6.5 PLS Test of the Structural Model

Figure 8 shows the full PLS model setup. Importantly, it illustrates that the three institutional pressures, namely mimetic, normative and coercive, are modelled as higher order factors. These second-order factors were all modelled in the formative mode. For Mimetic pressure, Mime1 and the latent factor score for perceived success of competitor adopters were modeled as its first-order formative indicators. For Coercive pressure, Coe6 and the latent factor scores for customer dominance and supplier dominance were modeled as its first-order formative indicators. For Normative pressure, Norm1, Norm3, Norm5, Norm6 and Norm7 were modeled as formative indicators. The latent factor scores were derived from the initial PLS run of the institutional theory variables as reflected in Appendix E, Figure 10.

Prior to testing Figure 8, a series of initial PLS models were tested as presented in Appendices D and E.

Appendix D, Figures 11 and 12 present the path coefficients and their associated t-values testing the effects of the Institutional Theory variables. Results illustrate the relatively more important impact of mimetic pressures was significant at the $p<0.05$ level.

Following the PLS test of the Institutional theory constructs, a PLS test of the DOI constructs was conducted (Appendix F: PLS Test of DOI Constructs). Appendix F, Figures 13 and 14 present the path coefficients and their associated t-values testing the effects of the DOI variables. Results illustrate the relatively more important impact of compatibility and relative advantage which were both significant at the $p<0.001$ level.

Appendix F, Figure 15 tests the combined effects of Institutional Theory and DOI variables. Results show that mimetic pressures have the largest effect followed by compatibility and relative advantage from DOI.

Finally, Figure 8 was tested and results presented in Figure 9 below.

Correlations between the constructs and other measurement model outputs as produced by PLS tests of Figure 8 are presented in Appendix H for the interested reader.

Results (Figure 9) show that Mimetic pressures retain a positive and significant effect on adoption, and top management championship also emerges as a significant internal organisational factor influencing adoption. None of the other institution or DOI variables retained significance with the inclusion of the top management championship variable, suggesting as per the regression results above, that TMC plays an important mediating effect. Complexity has a negative effect and in the expected direction but was not significant.

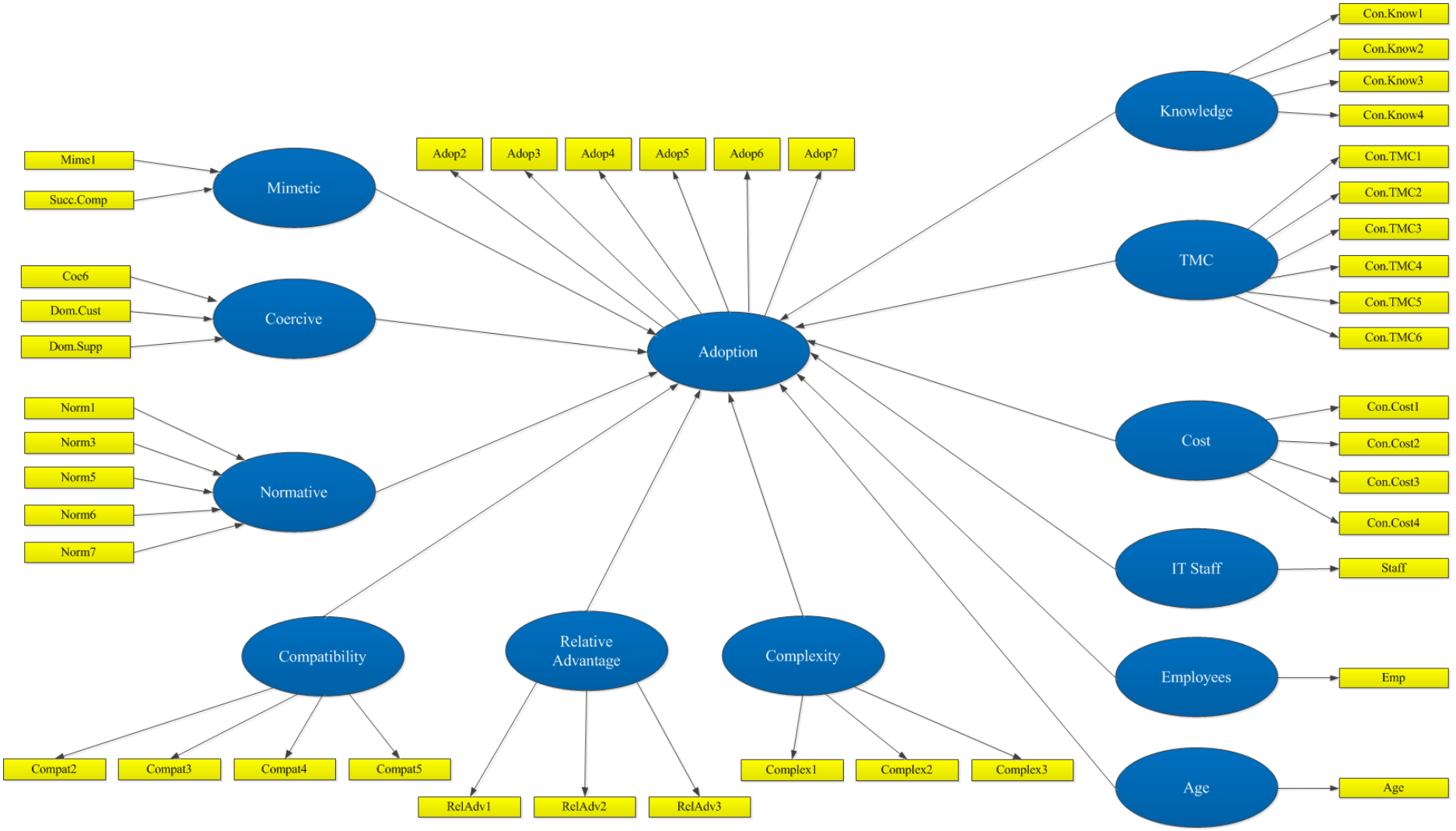

Figure 8: PLS Model Set-up

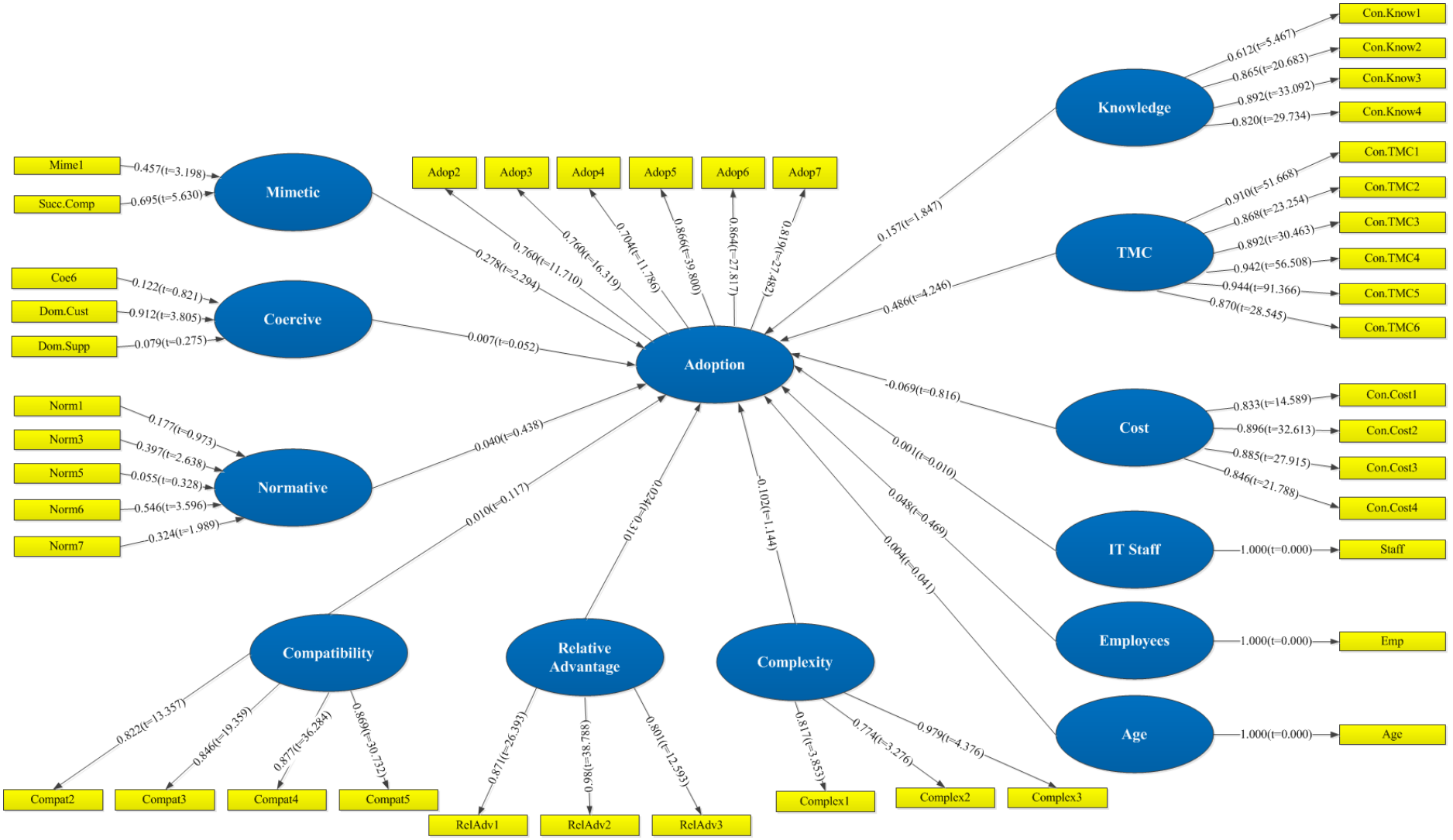

Figure 9: Path Coefficients and T-values for Measurement and Structural Model

5.7 CHAPTER CONCLUSION

Chapter 5 detailed the empirical findings of this study. Through this chapter the data cleaning, missing data and outlier analysis steps were explained. In addition, a detailed respondent profile was discussed and a descriptive summary of cloud computing adoption based on the respondent data. Following initial tests for reliability and validity, correlations and regression analyses were carried out before finally running the PLS analyses as a basis for accepting or rejecting the study's hypotheses. Table 34 provides a tabular summary of the results of hypothesis testing. Despite correlation, regression and initial PLS tests supporting the effects of the institution and DOI factors on adoption, the final PLS run found that top management championship was an extremely relevant internal organisational factor, and that its effects may largely mediate the effects of the other factors.

Hypothesis	Description	Without inclusion of TMC in model	With inclusion of TMC in model
H1	*Greater mimetic pressures will lead to greater adoption of cloud computing.*	*Accepted*	*Accepted*
H1a	*Greater extent of cloud computing adoption amongst an organisation's competitors is a mimetic pressure that will lead to greater adoption.*	*Accepted*	*Accepted*
H1b	*Greater perceived success of competitors, attributable to cloud computing, is a mimetic pressure that will lead to greater adoption.*	*Accepted*	*Accepted*
H2	*Greater coercive pressure will lead to greater cloud computing adoption*	*Rejected*	*Rejected*
H2a	*Greater perceived dependence on suppliers that have adopted cloud computing will lead to greater intent to adopt*	*Rejected*	*Rejected*
H2b	*Greater perceived dependence on customers that have adopted cloud computing will lead to greater intent to adopt.*	*Rejected*	*Rejected*
H2c	*Adoption of cloud computing by parent corporation will lead to greater intent to adopt.*	*Rejected*	*Rejected*
H3	*Greater normative pressures will lead to greater adoption of cloud computing.*	*Rejected*	*Rejected*
H3a	*Greater extent of cloud computing adoption among an organisation's suppliers is a source of normative pressure that will lead to greater adoption.*	*Rejected*	*Rejected*
H3b	*Greater extent of cloud computing adoption among an organisation's customers is a source of normative pressure*	*Accepted*	*Rejected*

Hypothesis	Description	Without inclusion of TMC in model	With inclusion of TMC in model
	that will lead to greater adoption.		
H3c	*Greater extent of participation in associations that promote and disseminate information about cloud computing is a source of normative pressure that will lead to greater adoption.*	*Rejected*	*Rejected*
H4	*Perceived relative advantage of cloud computing innovations will be positively associated with the adoption of cloud computing*	*Accepted*	*Rejected*
H5	*Perceived complexity of cloud computing innovations will be negatively correlated with the adoption of cloud computing.*	*Rejected*	*Rejected*
H6	*Compatibility of cloud computing innovations with existing IT will be positively correlated with the adoption of cloud computing.*	*Accepted*	*Rejected*

Table 54: Summary of Findings

The next chapter presents a discussion of the results with reference to literature and the aims and objectives of the research.

6 DISCUSSION OF RESULTS

6.1 INTRODUCTION

The aim of this research study was to develop and subsequently test a model of the institutional pressures and IS innovation characteristics that influence organisational adoption of cloud computing. Theoretical constructs drawn from Institutional Theory and Diffusion of Innovation Theory were hypothesized to predict adoption. Data was collected from 87 South African firms and was used to test the hypotheses and the empirical results were presented in the previous chapter.

This chapter draws together a discussion of the empirical findings of the effects on adoption of Institutional Theory, DOI, and the organisational factors used as controls.

6.2 DISCUSSION OF RESULTS

The upcoming sections provide a discussion of the significance of the effects on adoption of institutional pressures, innovation characteristics and controls respectively.

6.2.1 Discussion of the Effects of Institutional Pressures on Adoption

Institutional theory argues that organisations exist in an environment where internal organisational changes such as the adoption of new technologies like cloud computing would be driven to a large extent by pressures on an organisation to conform (Teo et al. 2003). Three pressures are theorized to form the basis for this conformity: mimetic, coercive and normative pressures.

6.2.1.1 Mimetic Pressures

Mimetic pressures can lead an organisation to change itself over time in order to become more like other organisations in its environment (Weerakkody et al. 2009). It is possible that an organisation considering the adoption of cloud computing may therefore look to other similar organisations within their environment and make their cloud computing adoption determination in order to imitate other organisations in their immediate environment. The more cloud computing has been adopted in an industry, the more likely it is that others in that industry will also adopt cloud computing. In addition to the general pressure to conform to peer organisations and to imitate their actions, organisations are also likely to observe and imitate the behaviours of organisations that are perceived to be especially successful (Ravichandran et al. 2009). Potential adopters of cloud computing are thus more likely to adopt if they perceive that cloud computing is a contributing factor to other organisations' successes. Teo et al. (2003) found mimetic pressures to have a significant influence on organisational adoption of IT innovations. Two mimetic pressures were therefore considered in this study. These were the adoption of cloud computing by competitors and perceived competitor success with cloud computing.

From Chapter 5 (Empirical Findings) it is evident from the path coefficient and t-value that mimetic pressures are significant. This finding is consistent with other studies such as Ravichandran et al. (2009), Teo et al. (2003), and Liang et al. (2007).

6.2.1.2 Coercive Pressures

Coercive pressures are defined as either formal or informal pressures that are exerted on an organisation by other organisations upon which there is a dependency (Soares-Aguiar and Palma-Dos-Reis, 2008). Such pressures were theorized to be important to the adoption of innovations because trading partners can exert coercive pressures to adopt specific IT solutions. For example, a dominant supplier is a source of coercive pressure that can impose on its trading partners the adoption of IT solutions or innovations considered important to achieving cost and/or process efficiencies that can be achieved through effective co-ordination across the supply chain (Ravichandran et al. 2003).

A dominant customer is also a source of coercive pressure and can exist when a customer makes up a large proportion of an organisation's sales revenue, and these customers can easily switch to another organisation for supply of product or services.

Lastly, there is another possible source of coercive pressure that arises not from a trading partner resource dependency but instead from parent corporations. Hence, parent corporations that have adopted cloud computing can apply pressure on subsidiaries to do likewise (Teo et al. 2003).

According to Teo et al. (2003), it was found that coercive pressures demonstrate a significant effect on adoption with compliance to parent organisations having a notable effect. Empirical results of this study found that coercive pressures have little additional effect on the adoption of cloud computing. However, it may also be the case that the effects are mediated by other internal organisational factors, specifically top management championship. Both Liang et al. (2007) and Shi et al. (2008) found the effects of coercive pressures on adoption to be mediated. This is considered further towards the end of this chapter.

Another explanation for the failure to support this hypothesis may be that suppliers and customers can exercise coercive pressure for many inter-organisational technologies and systems such as EDI, email, fax, XML standards, and web services. However, this is less probable for "in-house" technology decisions such as operating systems, virtualisation, storage area network (SAN) use or, indeed, the use of cloud computing which does not really affect them.

6.2.1.3 Normative Pressures

Normative pressures arise from dyadic relations; these dyadic relations are a form of 'social contagion', whereby a focal organisation with direct or indirect ties to other organisations learns from them through the sharing of information, norms and rules (Soares-Aguiar and Palma-Dos-Reis, 2008). Hence, in the context of IT adoption, the normative pressures that an organisation faces regarding the adoption of cloud computing are heightened when cloud computing has been adopted amongst its suppliers, customers and by its participation in professional, trade, or business organisations that endorse the adoption of the IT infrastructure.

Teo et al. (2003) found that normative pressures exhibited the strongest effect on organisational predisposition to adopt innovative IT and went on to identify how the norms espoused through business and professional associations particularly, played a major role in influencing organisational decision-makers. Through this study's data analysis it was found that normative pressures have very little significant effect when explaining adoption, however the relative strength of TMC on adoption can be understood through decision-makers being exposed to cloud computing through business and

professional associations and thereby strengthening the decision to adopt. Thus normative pressures may strongly influence top managers who in turn translate those pressures into institutional intentions.

Overall, in relation to the institutional pressures, this study found mimetic pressures to have the greatest direct effect on adoption than either normative or coercive pressures. This result differs to that of Teo et al. (2003) who found that normative pressures exhibited the strongest influence on organisational adoption. However, their context was inter-organisational systems. The adoption of an inter-organisational system is likely to be strongly influenced by suppliers and customers as such systems are more directly intended to support the dyadic relationships between them. In contexts such as cloud computing adoption where the systems may not necessarily be inter-organisational, it would make sense that a focal organisation's technology choices would be more strongly influenced by the actions of competitors than trading partners. The effects of normative and coercive pressures may however be indirect through their effects on top management attitudes (see further discussion below).

6.2.2 Discussion of the Effects of Innovation Characteristics on Adoption

Diffusion of Innovations Theory (DOI) describes the diffusion of innovations as a process whereby knowledge of the innovation disseminates throughout a population, with the eventual outcome being that the innovation is either adopted or not adopted by an organisation (Rogers 1983). Tornatzky and Klein (1982) identified three characteristics of technological innovations that would influence their diffusion. These three characteristics are: relative advantage, compatibility, and complexity.

6.2.2.1 Relative Advantage

Relative advantage of an innovation can be understood as the degree to which the innovation is perceived to be better than its precursor (Thong 1999). The benefits of cloud computing derive from abstracting the physical resources of a computing system and how these resources are provisioned as services so as to realise utilisation and rapid provisioning efficiencies (Low, Chen, and Wu 2011). It is assumed that these benefits lead to: lower cost of entry to access computing resources since hardware resources can be made available with no upfront capital investment, rapid provisioning in flexible time-frames, and IT barriers to innovation are reduced (Marston et al. 2011). Positive perceptions of these and other advantages that might flow from cloud computing should provide incentive for organisations to adopt.

Although relative advantage correlated strongly with adoption, it was found that in the presence of all the other factors, that its effects were less significant. Thus positive perceptions of the advantages that might flow from cloud computing might be necessary but is not necessarily sufficient to drive adoption.

6.2.2.2 Complexity

Complexity was defined as the degree to which cloud computing is perceived as difficult to understand and use (Tornatzky and Klein, 1982). The greater these perceived complexities, the less likely should be an organisation's decision to adopt cloud computing as an IS innovation. Empirical results showed that perceptions of complexity was negatively related to adoption, and therefore its relationship was in the expected direction, however the effect was not significant in the presence of other factors.

Low et al. (2011) similarly found complexity to be an insignificant determinant of cloud computing adoption. Complexity may therefore be an important consideration for some firms but is not on average a significant detractor from adoption. Future research may wish to explore for which organisations complexity is more relevant e.g. those with less IT knowledge and capacity.

6.2.2.3 Compatibility

For the purposes of this study compatibility is defined as cloud computing compatibility with the existing organisational work applications, IT infrastructures and systems as utilised by the adopting organisation. Compatibility was found to be positively related to innovation adoption and implementation (Tornatzky and Klein 1982). Empirical results showed that compatibility was correlated with adoption. However it did not add additional explanatory power in the full model. Low et al. (2011) similarly found compatibility not be a significant determinant of cloud computing adoption, providing a possible of explanation for this as being attributable to the immaturity of cloud computing.

6.2.3 Discussion of the Effects of Additional Organisational Factors on Adoption

Prior research identified a number of additional organisational factors that should be controlled for because of their influence on organisational adoption intention. By controlling for these factors, the direct effects of the institutional pressures and IS innovation characteristics could be better isolated.

6.2.3.1 Organisation Size

Organisational size was determined based on company age, number of employees, and number of IT staff. The underlying premise here is that larger organisations have additional capacity to purchase expensive innovations, withstand operational failures, and ensure contingency measures in the form of running systems in parallel allowing for phasing out of legacy IT (Low et al. 2011). The converse of this is that smaller organisations are more focused on survival and are less likely to possess additional slack capacity. Small organisations are therefore less likely to withstand cloud computing adoption hurdles (Liang et al. 2007).

Low et al. (2011) found firm size to be a significant determinant of cloud computing adoption. However, this study did not find size an important factor.

6.2.3.2 Innovation Cost

It was assumed that innovation cost would have a negative relationship to the adoption and implementation of an IS innovation, whereby the less expensive the IS innovation, the higher the likelihood that it will be quickly adopted and implemented (Tornatzky and Klein 1982). Cost was found to correlate negatively with adoption but these effects were not significant. This is consistent with both the meta-analysis by Tornatzky and Klein (1982) and the study by Premkumar et al. (2004).

6.2.3.3 Employees' IT Knowledge

A key aspect of the learning perspective is that improvements in assimilation are realised when organisations have prior experience in a given area that has allowed the organisation to build knowledge, this knowledge relates to the ability to assimilate external information and apply it internally. This ability is termed absorptive capacity and based on previous research it is believed to

be a key component in an organisation's innovative capability. Absorptive capacity has also been used as a means of explaining IT usage in organisations (Liang et al. 2007).

Furthermore, empirical evidence exists that supports the view that organisations with employees who have prior IS knowledge of an IS innovation will be more likely to use more of the innovation (Thong 1999).

This study found that employee IT knowledge is a somewhat significant ($p<0.10$) determinant of adoption and therefore an important consideration for explanation of cloud computing adoption.

6.2.3.4 Top Management Championship

Finally, attention is turned to the role of top management championship, which emerged from the statistical tests as having the largest significant direct effect on adoption. The role of top management championship can be understood through two key conceptual stages through which top management supports an organisational initiative, namely belief and participation. Top management should believe that an IT innovation can potentially benefit an organisation and should actively participate in the management of an IT innovation adoption (Liang et al. 2007). Empirical results show that cloud computing adoption is less likely to occur in those organisational contexts where such beliefs and actions, collectively referred to here as championship, are absent.

This chapter earlier alluded to the potential mediating effect of top management championship on the effects of other factors (particularly institutional pressures) on adoption. Liang et al. (2007) in their study of the assimilation of enterprise systems focused on this mediating role of TMC and found that TMC mediated the effects of coercive pressures on adoption.

These findings therefore suggest that the effects of external pressures must first be interpreted by organisational management. In other words, institutional pressures affect organisational actions (such as cloud adoption) through their effects on the attitudes and beliefs of managers. These managers must in turn translate those beliefs into action. Coercive and other pressures cannot directly influence adoption without organisational management's intervention. The results did however show that mimetic pressures have a strong effect on adoption and demonstrate relational significance even in the presence of top management championship. This suggests that the effects of mimetic pressures may thus be partially mediated by TMC and other factors might be responsible for translating these effects onto adoption behaviours.

6.3 SUMMARY OF DISCUSSION RESULTS

The stated aim of this study was to develop and subsequently test a model of the institutional pressures and IS innovation characteristics that influence organisational adoption of cloud computing. Through the data analysis the strength of the relative effects as well as the significance of the effects was tested.

In summary, it is evident that TMC as an internal organisational factor is very important and may mediate the effects of other factors on adoption. It was found that mimetic pressures are more important than normative pressures and coercive pressures whose effects are likely fully mediated by TMC. The importance of the DOI factors cannot be entirely ruled out but were less significant in the presence of TMC.

7 CONCLUSION

7.1 RESEARCH SUMMARY

This study investigated the adoption of cloud computing as a form of innovative IT, the investigation into the factors that explain this adoption was focused through the lens of Institutional Theory and Diffusion of Innovation Theory.

Cloud computing is a form of innovative IT offering an organisation the means to effectively and efficiently rent on-demand IT resources as a service. There are three generally agreed cloud services delivery models: Software-as-a-service (SaaS), Platform-as-a-service (PaaS) and Infrastructure-as-a-service (IaaS). Each of these cloud services models meet different organisational requirements and target different customers, but they all offer advantages to organisations willing to adopt. Even though cloud computing offers advantages it is not without shortcomings that are tempering the rate of adoption and the types of service delivery models being adopted.

The aim of this research study was to develop and subsequently test a model of the institutional pressures and IS innovation characteristics that influence organisational adoption of cloud computing.

To achieve this aim, the research had the following objectives:
First, to conduct a systematic literature review to gauge the state of the field and then to develop the research model hypothesizing the effects of selected institutional pressures suggested by Institutional Theory and technology innovation characteristics suggested by Diffusion of Innovations Theory on cloud computing adoption. In addition, to the variables drawn from Institutional Theory and DOI, the research model included necessary controls such as top management championship, employees' IS knowledge, organisation size and innovation cost.

Second, the research model was tested using a survey methodology. This required that the variables hypothesized in the research model were operationalised from the literature and the questionnaire instrument was developed. The self-administered online questionnaire was administered to a sample of 980 medium-to-large South African organisations of which 120 responses were received. Following initial screening, 87 usable responses were retained analysis. For the purposes of this study internal consistency reliability was measured using Cronbach's alpha; principal component analysis (PCA) was used to assess convergent validity and discriminant validity. The stated hypotheses were tested initially with correlation and regression techniques before using partial least squares (PLS).

Through the descriptive analysis of cloud computing adoption it was discovered that cloud computing in the form of IaaS, SaaS, and PaaS has diffused across industries and organisations of varying sizes with just under one third of respondents not having adopted any form of cloud computing. Hence, from this study it is observed that the diffusion of cloud computing is steadily progressing within South Africa but there is still some way to go before cloud computing becomes broadly adopted.

While all the Institutional Theory and DOI factors were found to correlate with adoption, the results of hypothesis testing showed that mimetic pressures are more important than normative pressures and coercive pressures. Furthermore, it is evident that TMC as an internal organisational factor is very important and may mediate the effects of other factors on adoption.

The limitations of the study and future research directions, as well as the implications for practice and research will be discussed in the next sections.

7.2 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Some limitations to the study are noted.

First, this research study was conducted in South Africa and was further focused on medium and large organisations, with the consequence that the findings may not be fully generalisable to other organisations in other geographies, and may not be generalisable to small organisations.

Second, even though medium and large organisations in South Africa were targeted, a sizable target sample, there were a limited number of usable responses (87). A greater number of responses may influence the relative effects of the institutional pressures, innovation characteristics and controls on adoption of cloud computing.

Third, the operationalisation of participation in industry, trade or professional bodies where management and staff get exposure to cloud computing promotional information may be potentially biased because organisations may also be exposed to negative information (e.g., adoption risks) through their participation in these bodies, this in turn can lead to negative sentiment (Teo et al. 2003).

Fourth, data collected was cross-sectional and therefore claims of causality cannot readily be made. Future research may wish to consider longitudinal case-study designs to better understand how institutional pressures and other factors come to influence adoption decisions over time.

The theoretical basis for this study is driven by the institutional perspective and not by the learning perspective whereby the top management and other organisational members engage in active learning (Liang et al. 2007); as can be seen from the structural and measurement model which indicates the direct effects of institutional pressures and innovation characteristics on cloud computing adoption, the data analysis points to the relative strength of TMC on adoption. This strength of TMC suggests that TMC may mediate the effects of the institutional pressures and innovation characteristics; hence for future research it may be worth examining the mediating effects of TMC on cloud computing adoption given that the institutional pressures and innovation characteristics explained 59.2% of the variance in adoption (Appendix F), leaving up to 40% un-explained. Therefore, there is much opportunity for future research to consider how other factors including TMC come to influence adoption.

Across the sample responses it was observed that of the cloud computing service models SaaS (50.6%) is the most diffused, followed by IaaS (44.8%), and PaaS (29.9%) which is the least adopted cloud service model across industries. Hence, it is clear that IaaS, PaaS, and SaaS are at different stages of diffusion within the South African context; as a result a future research direction could be to more closely examine the determinants driving the adoption of each of these respective cloud computing service delivery models.

Relatively few studies have used institutional theory as a lens through which to examine IT adoption by organisations. Consequently, the measures for mimetic pressures, coercive pressures, and normative pressures are more embryonic than those of other more established constructs. Future

research should work on improving the measurement scales for the institutional pressures so as to further advance the application of institutional theory in future IT adoption studies.

7.3 IMPLICATIONS FOR RESEARCH

Through the systematic literature reviews conducted for this study it was found that while prior empirical academic research undertaken to better understand organisational adoption of cloud computing had contributed to our understanding of this innovative IT, there is still much to be learnt about the factors that affect organisational adoption of cloud computing, since this is still a relatively under studied area with a limited amount of research having been undertaken focusing on cloud computing as the IT artefact of interest.

It was also discovered that limited empirical research on the organisational adoption of cloud computing is available that pre-dates 2009, which supports the positioning of cloud computing as a technology innovation. With an additional shortcoming resulting from limited research having been done that focuses on the decision-making factors affecting adoption of cloud computing by organisations.

Furthermore, it was discovered that very limited research has been undertaken regarding the adoption of cloud computing within the South African context, and importantly no research using Institutional Theory and DOI to explain adoption of cloud computing in the South African context.

As per Oliveira and Martins (2011), most empirical studies of IT adoption at the firm level are derived from DOI theory and technology, organisation and environment (TOE) framework, with no clearly identified research being undertaken combining Institutional Theory and DOI theory to explain the IT innovation adoption phenomenon at firm level. Hence, from an Institutional Theory perspective, this study extends its applicability to an IT innovation adoption context, specifically the adoption of cloud computing within the South African context. Moreover, this study uses Institutional Theory to examine cloud computing adoption within South Africa where it is not well diffused.

From a DOI perspective it was found that DOI is also a widely used theory to explain adoption of IT with a focus on innovative IT, with DOI being the more commonplace theory than Institutional Theory. From this study it was found that the effects on adoption of some of the DOI factors, such as complexity, differed to the findings from other research that was undertaken in different geographical contexts. Interestingly, the systematic literature review revealed that there is a shortcoming in the existing literature using DOI and Institutional Theory to explain adoption of innovative IT.

The finding that top management championship may be an important mediating variable in the effects of the institutional factors on adoption provides useful guidance to future researchers looking to apply Institutional Theory to the study of adoption.

7.4 IMPLICATIONS FOR PRACTICE

This study provides several practical implications for cloud computing vendors and organisational adopters of IT innovation.

First, an important implication arising from this study's results is that cloud computing vendors wishing to promote adoption can enhance the effects of mimetic pressure by highlighting for potential

adopters that other competitor organisations have successfully adopted cloud computing. Publication of case study and success stories may be one mechanism to achieve this.

Second, vendor should also focus on speaking to top managers rather than IT employees since without the championship of top managers, cloud adoption is not likely to occur. To promote cloud computing among potential adopting organisations cloud service providers should provide positive reinforcement of the benefits of cloud computing. This can be done directly with top management as well as within trade bodies and professional associations,. By making the benefits of cloud computing adoption more observable to organisations it will help these organisations understand the concept and realise the potential benefits.

Third, vendors should focus on the cloud service model adopted (IaaS, PaaS, and SaaS) given that an organisation that has already adopted at least one of these models may be more likely to adopt another model and further diffuse the service model already adopted.

A fourth implication is the importance of employees IT knowledge. Organisations that have either adopted or are considering adoption having organisational IT knowledge of cloud computing should ensure adequate knowledge of cloud computing exists within the firm. This may have a bearing on the perceived complexity of the technology as well as on ensuring the compatibility of cloud computing with the organisation's existing IT.

Top managers must importantly understand the role they play in affecting the adoption of technology innovations. Through their beliefs and active participation, top management can bring impetus to the adoption process. Without their support, cloud computing is likely not to diffuse effectively. They are an important medium through which external institutional pressures are filtered.

7.5 CONCLUSION

This research has discussed the emergence of cloud computing and the various facets of the service models making up this fashionable innovation which represents a fundamental shift in how organisations pay for and access IT. Given the advantages and benefits cloud computing offers, it is a technology that holds much promise for organisations and its rate of adoption by firms and consequently its diffusion into the market place deserves attention.

A research model was developed, aimed at understanding organisational adoption of cloud computing through the lens of Institutional Theory and Diffusion of Innovation Theory. The model was tested within the South African context using a relational research design and survey methodology. While this study focused on a South African context the potential benefits of cloud computing are global in nature.

From an Institutional Theory and Diffusion of Innovation Theory perspective, this research provides an application of these two theories to an organisational level IT innovation adoption context, specifically that of cloud computing. The theoretical implications of this study indicate a meaningful contribution has been made by applying Institutional Theory and DOI theory to the study of cloud computing adoption and providing empirical evidence of their relative effects.

The practical implications of this study are applicable to organisational IT decision-makers and technology vendors. For those organisations who are considering adoption this research offers insights into the relative influence of institutional pressures and IS innovation factors and how these factors

weighed on other organisations decision-making, for organisations that are either contemplating cloud computing adoption or plan to adopt within the next 12 months.

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APPENDIX A: ETHICS CLEARANCE

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON MEDICAL)
R14/49 Trope

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER H13/03/08**
PROJECT TITLE	Adoption of cloud computing by SA firms: an institutional theory and diffusion of innovation theory perspective
INVESTIGATOR(S)	Mr J Trope
SCHOOL/DEPARTMENT	Economic and Business Sciences/
DATE CONSIDERED	15/03/2013
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	01/04/2015
DATE 02/04/2013	**CHAIRPERSON** (Professor T Milani)

cc: Supervisor : Professor J Cohen

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

(J.TROPE) 02/04/2013

Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

APPENDIX B: SURVEY COVER LETTER

Dear IT Practitioner,

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

For the purposes of my degree, I am conducting an empirical research study on the adoption of cloud computing, across South African firms. As an IT decision-maker within your organisation I am inviting you to complete an online questionnaire pertaining to whether your organisation has adopted cloud computing, whether your organisation is contemplating cloud computing adoption or are likely to adopt cloud computing within a year. If you consent to participate, the online survey will take approximately 15 minutes to complete. The questionnaire consists of 62 questions related to company demographics, environmental pressures and IT innovation characteristics.

Please understand that your participation is voluntary. The choice of whether to participate or not, is yours alone. No risks, penalties or losses will be incurred if you opt not to participate in the study. If you agree to participate, you may stop participating in the research at any time by simply exiting from the online survey. If you do this, there will be no penalties or losses and you will not be prejudiced in any way.

This questionnaire is for research purposes only. There are no right or wrong answers. All responses will be kept strictly confidential. Moreover, all responses are anonymous as neither your name nor any information that can be used to identify your organisation is recorded. Results will only be reported in the aggregate and a copy of the report will be made available to respondents on request. All data will be destroyed once the University requirements have been met.

Results of this study will promote our understanding of cloud computing adoption by South African firms and the factors influencing the organisational adoption decision. This study was approved unconditionally by the Wits Human Research Ethics Committee (Non-Medical), protocol number: H13/03/08.

Thank you for considering your participation. If you would like to receive feedback on my study or have any concerns or questions about the research please contact me on 9805593H@students.wits.ac.za or (082) 092 8577 or you may contact my supervisor Professor Jason Cohen in the School of Economic and Business Sciences, jason.cohen@wits.ac.za
By submitting the completed questionnaire your consent to participate in the research is assumed and you understand that you are participating voluntarily and that you can withdraw your participation at any stage.

Jonathan Trope
Master of Commerce student
School of Economic and Business Sciences
University of the Witwatersrand, Johannesburg

APPENDIX C: SURVEY QUESTIONNAIRE

ADOPTION OF CLOUD COMPUTING BY SOUTH AFRICAN FIRMS: AN INSTITUTIONAL THEORY AND DIFFUSION OF INNOVATION THEORY PERSPECTIVE

Dear IT Practitioner,

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

For the purposes of my degree, I am conducting an empirical research study on the adoption of Cloud Computing, across South African firms. As an IT decision-maker within your organisation I am inviting you to complete an online questionnaire pertaining to whether your organisation has adopted Cloud Computing, whether your organisation is contemplating Cloud Computing adoption or are likely to adopt Cloud Computing within a year. If you consent to participate, the online survey will take approximately 15 minutes to complete. The questionnaire consists of 62 questions related to company demographics, environmental pressures and IT innovation characteristics.

Please understand that your participation is voluntary. The choice of whether to participate or not, is yours alone. No risks, penalties or losses will be incurred if you opt not to participate in the study. If you agree to participate, you may stop participating in the research at any time by simply exiting from the online survey. If you do this, there will be no penalties or losses and you will not be prejudiced in any way.

This questionnaire is for research purposes only. There are no right or wrong answers. All responses will be kept strictly confidential. Moreover, all responses are anonymous as neither your name nor any information that can be used to identify your organisation is recorded. Results will only be reported in the aggregate and a copy of the report will be made available to respondents on request. All data will be destroyed once the University requirements have been met.

Results of this study will promote our understanding of Cloud Computing adoption by South African firms and the factors influencing the organisational adoption decision. This study was approved unconditionally by the Wits Human Research Ethics Committee (Non-Medical), protocol number: H13/03/08.

Thank you for considering your participation. If you would like to receive feedback on my study or have any concerns or questions about the research please contact me on 9805593H@students.wits.ac.za or (082) 092 8577 or you may contact my supervisor Professor Jason Cohen in the School of Economic and Business Sciences, jason.cohen@wits.ac.za
By submitting the completed questionnaire your consent to participate in the research is assumed and you understand that you are participating voluntarily and that you can withdraw your participation at any stage.

Jonathan Trope
Master of Commerce student
School of Economic and Business Sciences
University of the Witwatersrand, Johannesburg

1 * Do you agree to participate?

- (•) Yes
- ( ) No

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Demographics

In this section of the survey, questions numbered 2 through to 7 are listed. These questions relate to respondent and organisational demographics.

INSTRUCTIONS:
Please select the appropriate option for the respective questions.

2 Job Title

- IT Manager
- IT Executive
- CIO
- Technology Manager
- Technology Executive
- General Manager
- Operations Manager
- Operations Executive
- Other

3 How long have you been employed by the organisation? (Years)

- Less than 1
- 1 to 2
- 2 to 4
- 4 to 8
- More than 8

4 What industry does the organisation fall within?

- Automotive and related
- Retail
- Food
- Manufacturing
- Financial Services and related
- Technology
- Telecommunications
- Health
- Other

5 Company Age (Years)

- Less than 5
- 5 to10
- 10 to 20
- 20 to 30
- More than 30

6 Number of employees within the organisation

- Less than 100
- 100 to 300
- 300 to 500
- 500 to 1000
- 1000 to 2000
- More than 2000

7 Number of IT staff within the organisation

- Less than 10
- 10 to 30
- 30 to 50
- 50 to 100
- 100 to 200
- More than 200

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Cloud Computing Adoption Decision

This section focuses on the adoption of Cloud Computing.

For the purposes of this study Cloud Computing is defined as: "*... an information technology service model where computing services (both hardware and software) are delivered on-demand over a network in a self-service fashion, independent of device and location. The resources required to provide the requisite quality-of-service levels are shared, dynamically scalable, rapidly provisioned, virtualised and released with minimal service provider interaction.*"

This study spans all types of Cloud-based environments whether the environment be categorised as a private, public or hybrid model. Furthermore, the three generally agreed cloud services delivery models of Software-as-a-service (SaaS), Platform-as-a-service (PaaS) and Infrastructure-as-a-service (IaaS) all fall under the broad definition of Cloud Computing.

INSTRUCTIONS:
Please respond to questions 8 and 14 based on your organisations current adoption of cloud computing and your organisation's likelihood to adopt.

8 My company has adopted Cloud Computing, if so indicate which service delivery models have been adopted:

- SaaS (Software as a Service)
- PaaS (Platform as a Service)
- IaaS (Infrastructure as a Service)
- None of the above

9 How likely is that you will adopt ***IaaS (Infrastructure as a Service)*** within the next year?

- 1 - Not at all likely
- 2 - Unlikely
- 3 - Somewhat likely
- 4 - Likely
- 5 - Very likely

10 How likely is that you will adopt ***PaaS (Platform as a Service)*** within the next year?

- 1 - Not at all likely
- 2 - Unlikely
- 3 - Somewhat likely
- 4 - Likely
- 5 - Very likely

11 How likely is that you will adopt ***SaaS (Software as a Service)*** within the next year?

- 1 - Not at all likely
- 2 - Unlikely
- 3 - Somewhat likely
- 4 - Likely
- 5 - Very likely

12 To what extent are Cloud Computing solutions replacing legacy technologies within your organisation?

- 1 - Very low
- 2 - Low
- 3 - Some
- 4 - High
- 5 - Very high

13 To what extent are Cloud Computing services currently used to deliver the technologies that support the ***business operations*** of your organisation?

- 1 - Very low
- 2 - Low
- 3 - Some
- 4 - High
- 5 - Very high

14 To what extent are Cloud Computing services currently used to deliver the technologies that support ***management decision making*** within your organization?

- 1 - Very low
- 2 - Low
- 3 - Some
- 4 - High
- 5 - Very high

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Institutional Pressures

The questions in this section, numbered 15 through 37, focus on the institutional pressures affecting an organisation's decision to adopt Cloud Computing. Institutional pressures are predominantly created by suppliers, customers and competitors.

INSTRUCTIONS:
Please respond to questions 15 to 37 by indicating the extent to which you agree or disagree with the following statements by selecting a number between 1 and 5 based on your organisation's situation.

15 What is the extent of Cloud Computing adoption by your firm's competitors currently?

- 1 - None have adopted
- 2 - Some have adopted
- 3 - Many have adopted
- 4 - Most have adopted
- 5 - All have adopted

16 Of your firm's competitors that have adopted Cloud Computing, which Cloud Computing service models have they adopted?

- SaaS (Software as a Service)
- PaaS (Platform as a Service)
- IaaS (Infrastructure as a Service)
- None of the above

17 Our main competitors that have adopted Cloud Computing are benefiting greatly.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

18 Our main competitors that have adopted Cloud Computing are perceived favourably by others in the same industry .

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

19 Our main competitors that have adopted Cloud Computing are perceived favourably by suppliers.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

20 Our main competitors that have adopted Cloud Computing are perceived favourably by customers.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

21 Competitive conditions in our industry require our firm to use cloud computing solutions.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

22 Our main customers require us to use cloud computing solutions.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

23 Our main suppliers require us to use cloud computing solutions.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

24 Many of our transactions with customers can only be accomplished if we used Cloud Computing.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

25 Many of our transactions with suppliers can only be accomplished if we used Cloud Computing.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

26 Our interactions with other businesses force us to use Cloud Computing.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

27 Our parent company requires us to use Cloud Computing.

- Yes
- No
- Not Applicable

28 What is the extent of Cloud Computing adoption by your firm's suppliers currently?

- 1 - None have adopted
- 2 - Some have adopted
- 3 - Many have adopted
- 4 - Most have adopted
- 5 - All have adopted

29 Of your firm's suppliers that have adopted Cloud Computing, which Cloud Computing service models have they adopted?

- ☐ SaaS (Software as a Service)
- ☐ PaaS (Platform as a Service)
- ☐ IaaS (Infrastructure as a Service)
- ☐ None of the above

30 Our main suppliers that have adopted Cloud Computing are benefiting greatly.

- ○ 1 - Strongly disagree
- ○ 2 - Disagree
- ○ 3 - Un-decided
- ○ 4 - Agree
- ○ 5 - Strongly Agree

31 What is the extent of Cloud Computing adoption by your firm's customers currently?

- ○ 1 - None have adopted
- ○ 2 - Some have adopted
- ○ 3 - Many have adopted
- ○ 4 - Most have adopted
- ○ 5 - All have adopted

32 Of your firm's customers that have adopted Cloud Computing, which Cloud Computing service models have they adopted?

- ☐ SaaS (Software as a Service)
- ☐ PaaS (Platform as a Service)
- ☐ IaaS (Infrastructure as a Service)
- ☐ None of the above

33 Our main customers that have adopted Cloud Computing are benefiting greatly.

- ○ 1 - Strongly disagree
- ○ 2 - Disagree
- ○ 3 - Un-decided
- ○ 4 - Agree
- ○ 5 - Strongly Agree

34 Most of the successful companies in our industry have adopted cloud computing.

- ○ 1 - Strongly disagree
- ○ 2 - Disagree
- ○ 3 - Un-decided
- ○ 4 - Agree
- ○ 5 - Strongly Agree

35 There is a great deal of conversation about cloud computing going on in the media.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

36 There is a very strong message in companies that you can't stay in business nowadays if you do not adopt cloud computing.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

37 Do you participate in any industry, trade or professional bodies where you have been exposed to Cloud Computing promotion and information?

- Yes
- No

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Innovation Characteristics

The questions in this section, questions 38 to 48, focus on various characteristics of Cloud Computing as an example of innovative IT.

INSTRUCTIONS:

Please indicate the extent to which you agree or disagree with the following statements by selecting a number between 1 and 5 based on your organisation's situation.

38 My company believes that Cloud Computing is conceptually difficult to understand from a technical perspective?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

39 My company believes that Cloud Computing implementation is a complex process?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

40 My company believes that using Cloud Computing is difficult?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

41 My company expects Cloud Computing to help lower on-going hardware and software costs?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

42 My company expects Cloud Computing to provide a rapid hardware and software provisioning capability?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

43 My company expects Cloud Computing to help reduce company owned hardware and software?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

44 The changes introduced by Cloud Computing are consistent with my firm's values?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

45 Cloud Computing is compatible with my company's existing hardware and software?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

46 Cloud Computing is compatible with my company's existing IT applications?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

47 The changes introduced by Cloud Computing are consistent with my firm's existing policies and procedures?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

48 Cloud Computing adoption is compatible with my firm's existing experiences with similar solutions?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

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Controls

The questions in this section, questions 49 to 62, focus on various characteristics of Cloud Computing as an example of innovative IT.

INSTRUCTIONS:
Please indicate the extent to which you agree or disagree with the following statements by selecting a number between 1 and 5 based on your organisation's situation.

49 Our IT staff have extensive experience in hardware and software?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

50 It is well known who within the IT team can help solve problems associated with Cloud Computing?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

51 Our company can provide adequate technical support for using Cloud Computing?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

52 Our company provides regular Cloud Computing training to its IT employees?

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

53 The senior management in your firm believe that Cloud Computing has the potential to provide significant business benefits to the firm.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

54 The senior management in your firm believe that Cloud Computing will create a significant competitive arena for the firm.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

55 The senior management in your firm believe that it is necessary to use Cloud Computing to conduct business activities.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

56 The senior management in your firm actively articulate a vision for the organisational use of Cloud Computing.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

57 The senior management in your firm actively formulate strategies for the organisational use of Cloud Computing.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

58 The senior management in your firm establish goals and standards to monitor Cloud Computing usage.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

59 The perceived benefits of Cloud Computing outweigh the costs of the initial investment.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

60 The perceived benefits of Cloud Computing outweigh the costs of staff training.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

61 The perceived benefits of Cloud Computing outweigh the costs of integrating Cloud Computing services with existing hardware and software.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

62 The perceived benefits of Cloud Computing outweigh the costs of integrating Cloud Computing with existing applications.

- 1 - Strongly disagree
- 2 - Disagree
- 3 - Un-decided
- 4 - Agree
- 5 - Strongly Agree

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APPENDIX D: PLS TEST OF INSTITUTIONAL THEORY

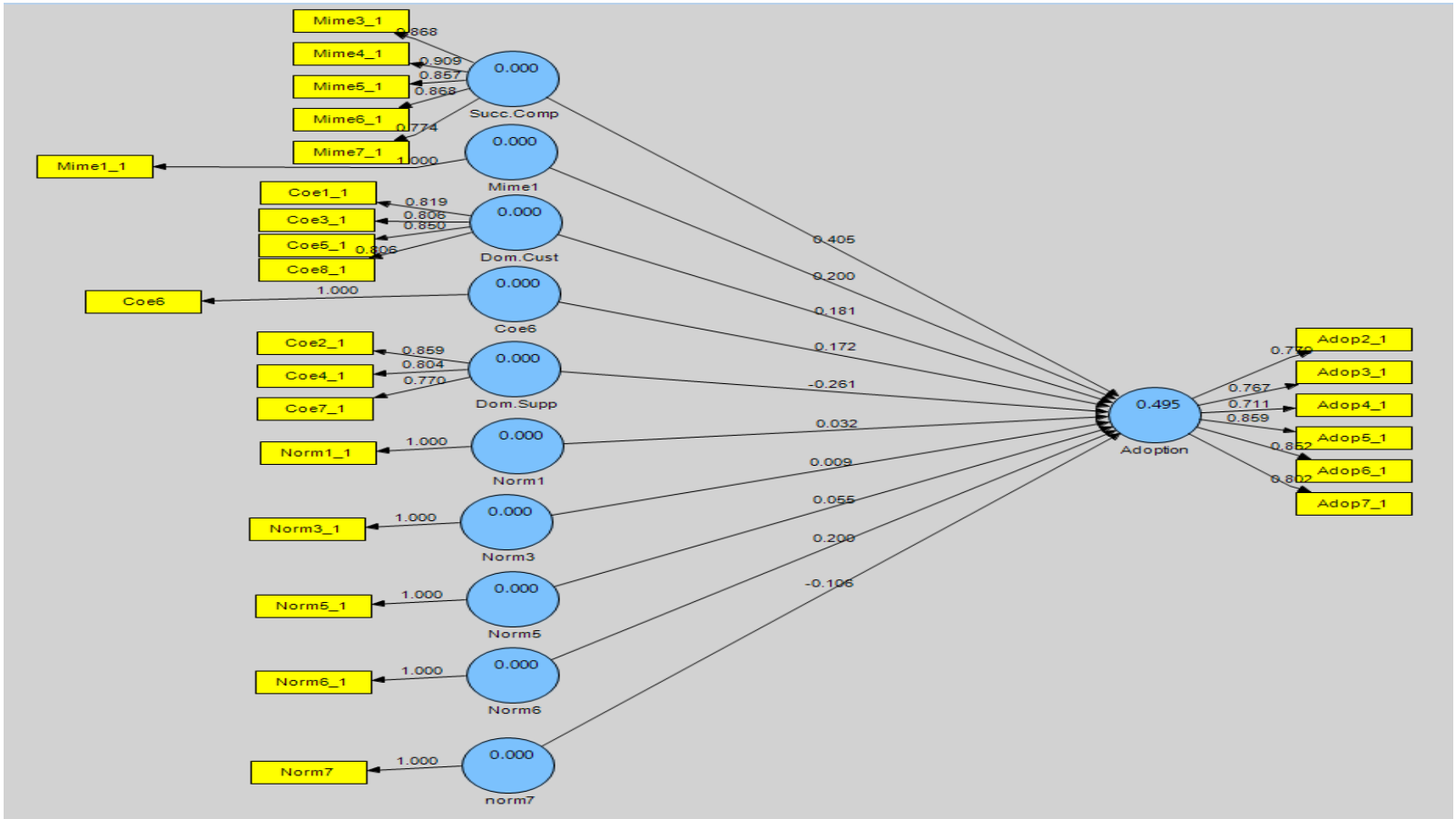

Figure 10: Path Coefficients of First Order Constructs

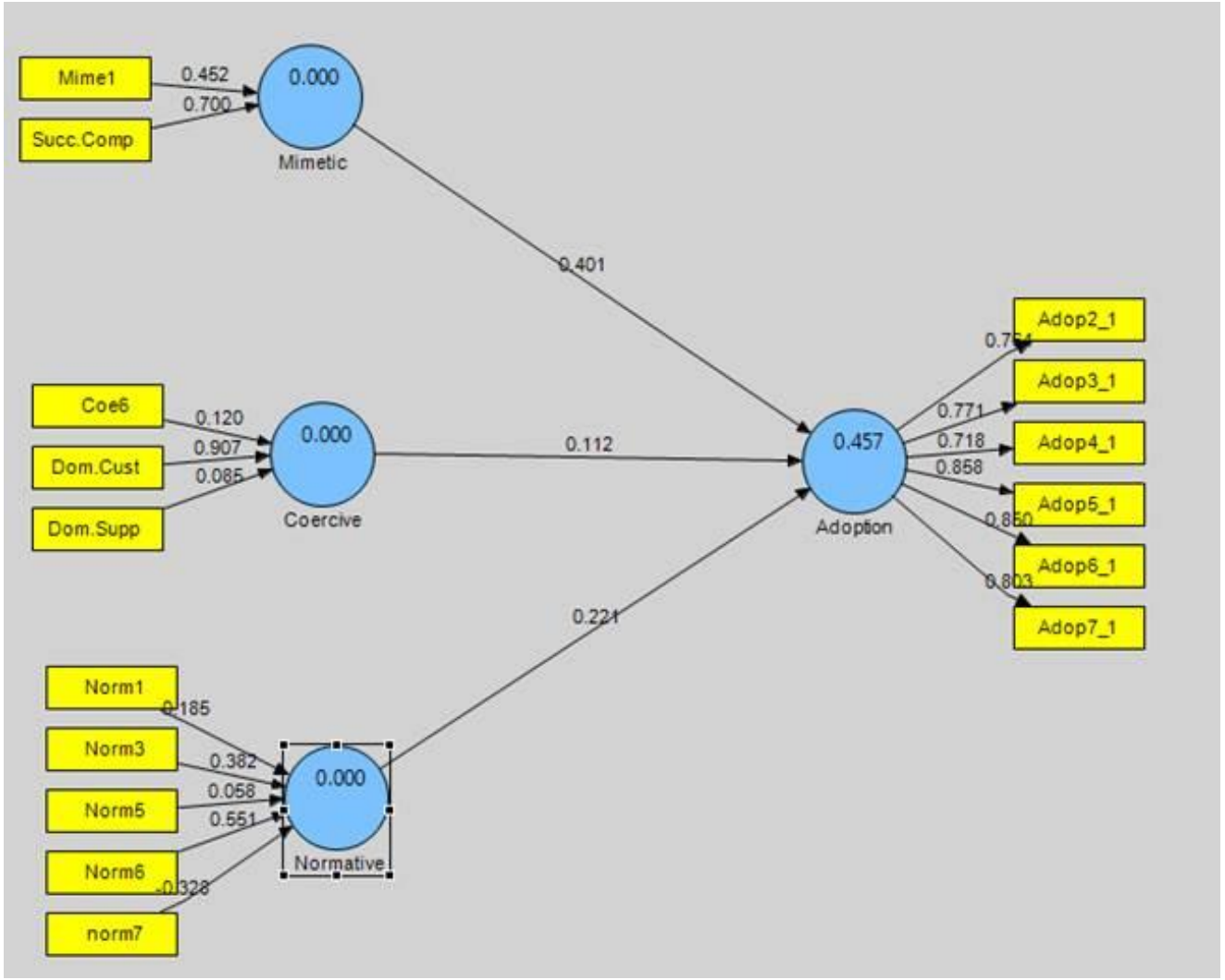

Figure 11: Path Coefficients of the Second Order Constructs

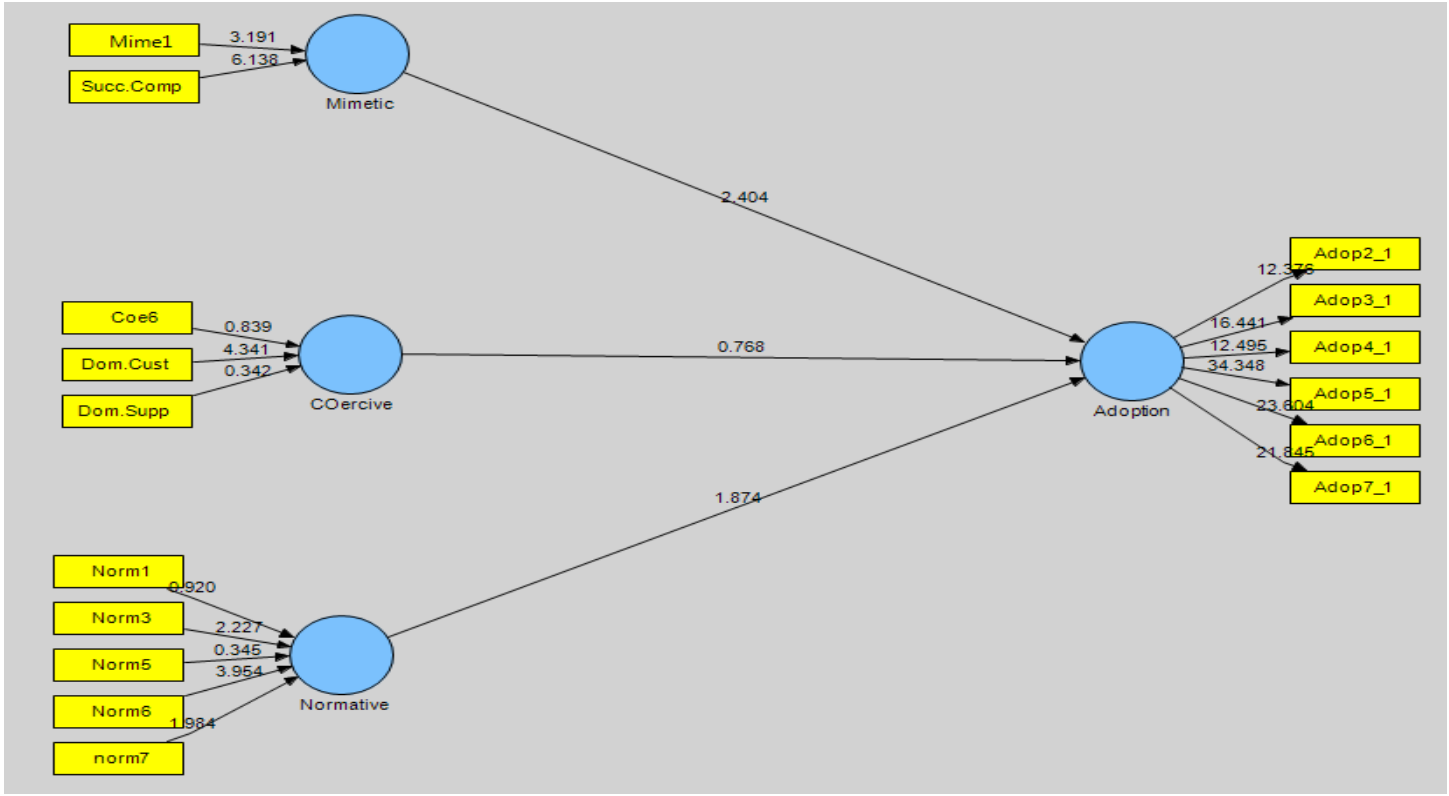

Figure 12: T-values of the Second Order Constructs

T-values were produced by bootstrap resampling, with n-1 degrees of freedom.
T-values greater than 2 are significant at the $p<0.05$ level; t-values greater than 2.65 are significant the $p<0.01$ level; t-values greater than 3.44 are significant the $p<0.001$ level.

APPENDIX E: PLS TEST OF DOI CONSTRUCT

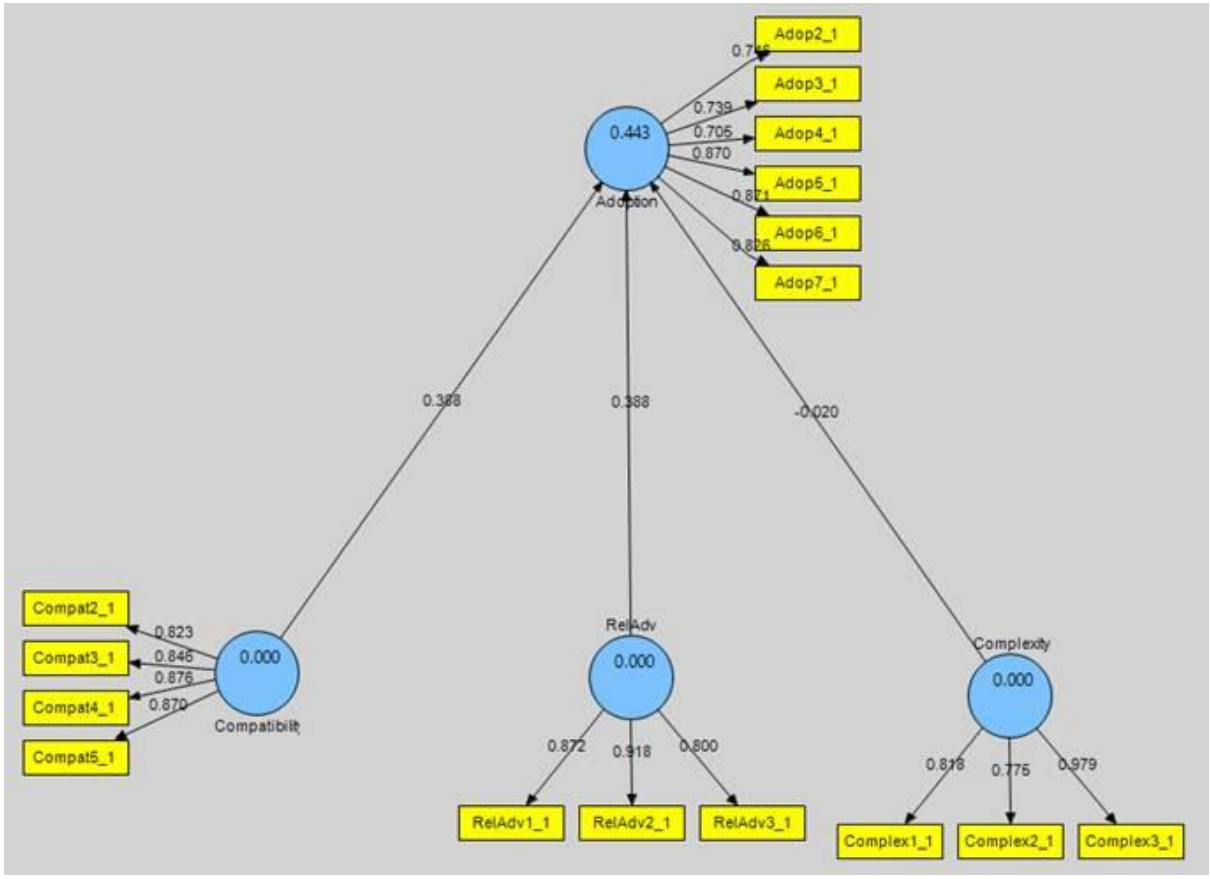

Figure 13: Path Coefficients of the DOI Constructs

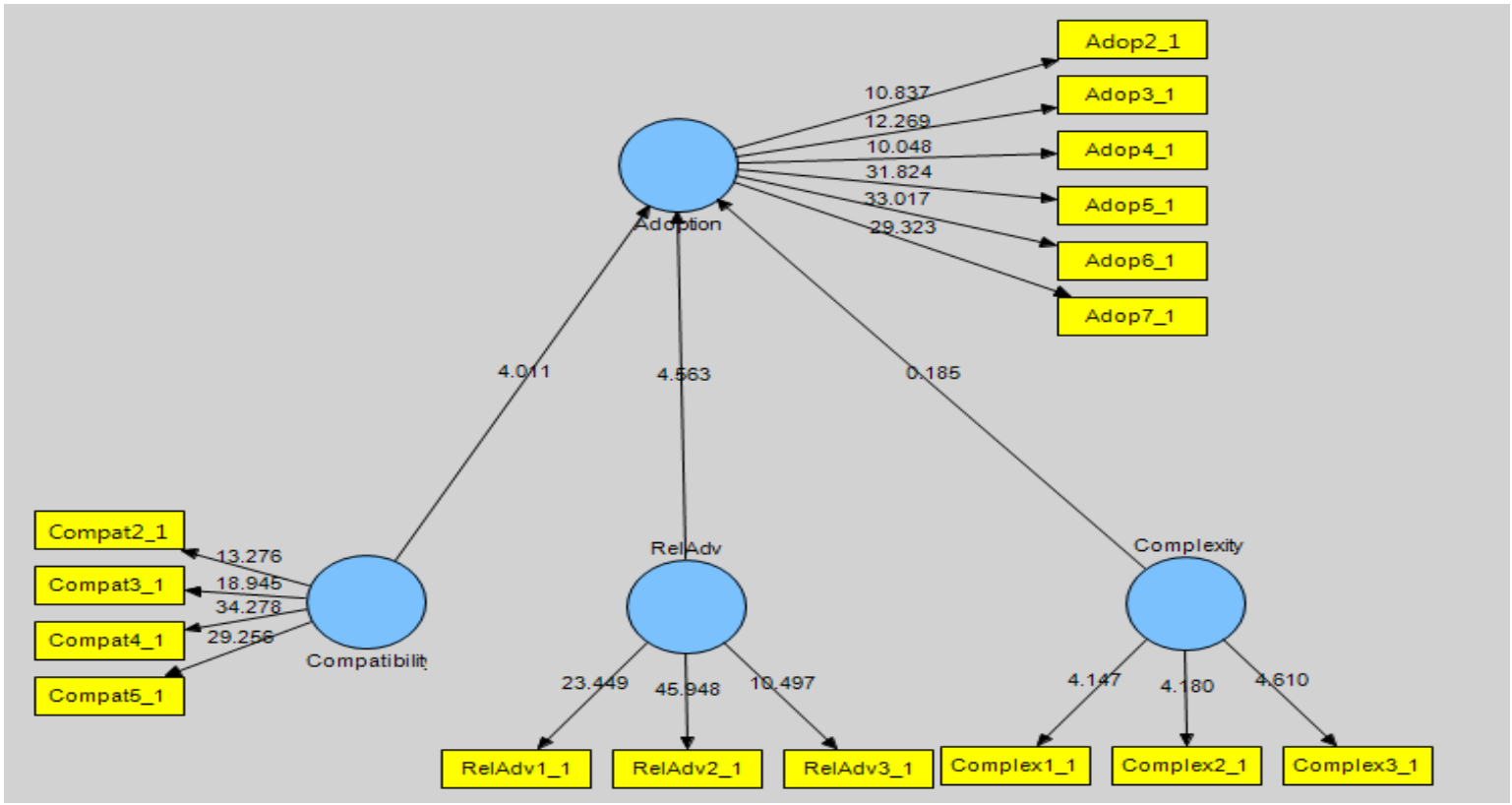

Figure 14: T-values of the DOI Constructs

T-values were produced by bootstrap resampling, with n-1 degrees of freedom.
T-values greater than 2 are significant at the $p<0.05$ level; t-values greater than 2.65 are significant the $p<0.01$ level; t-values greater than 3.44 are significant the $p<0.001$ level.

APPENDIX F: PLS TEST OF INSTITUTIONAL THEORY AND DOI CONSTRUCTS

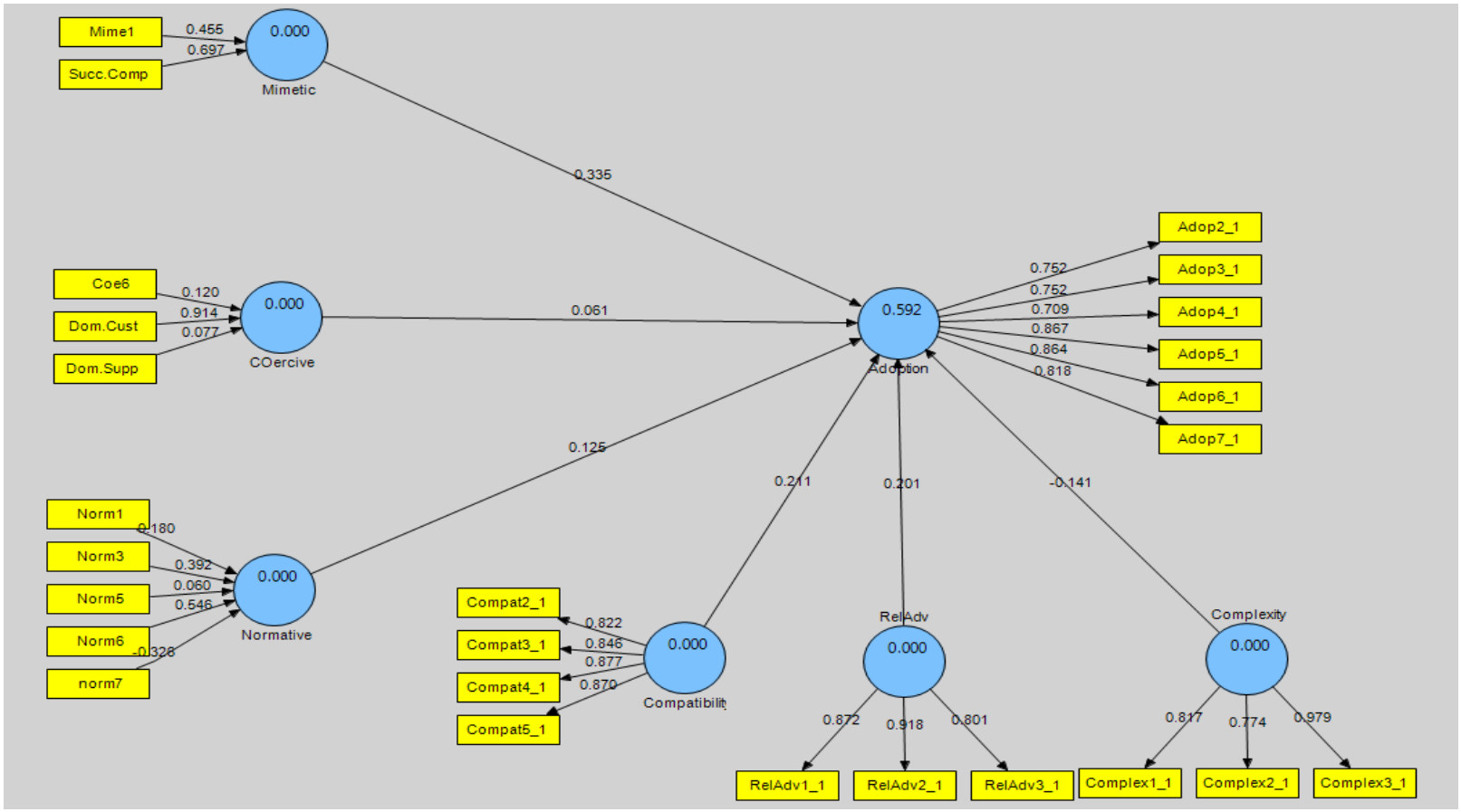

Figure 15: Path Coefficients of the Institutional Pressures and DOI Constructs

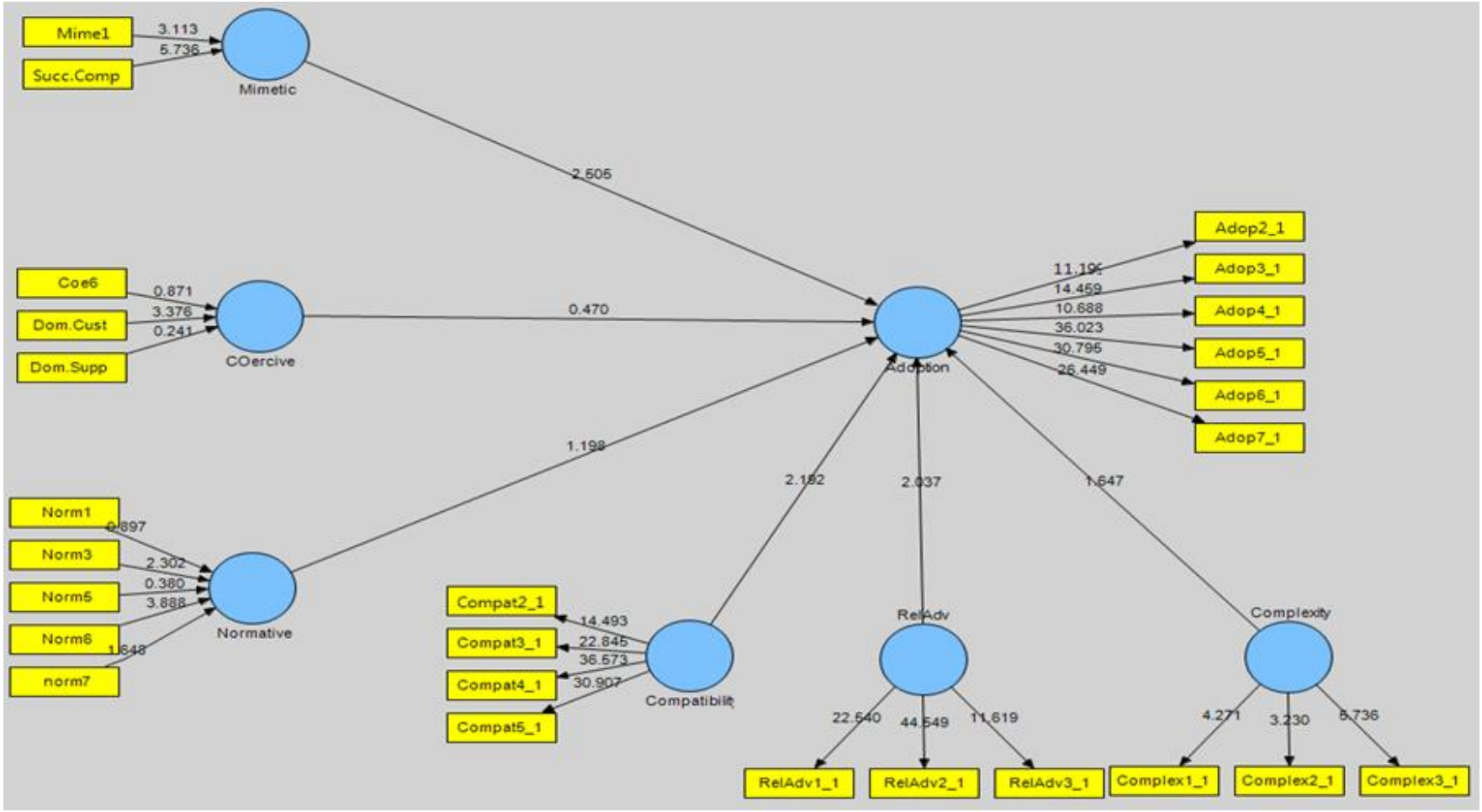

Figure 16: T-values of the Institutional Pressures and DOI Constructs

T-values were produced by bootstrap resampling, with n-1 degrees of freedom.
T-values greater than 2 are significant at the $p<0.05$ level; t-values greater than 2.65 are significant the $p<0.01$ level; t-values greater than 3.44 are significant the $p<0.001$ level.

APPENDIX G: AVE, COMPOSITE RELIABILITY, AND LATENT VARIABLE CORRELATIONS

AVE	
#Employees	1
#ITStaff	1
Adoption	0.633507
Age	1
Coercive	
Compatibility	0.72905
Complexity	0.741526
Cost	0.748838
Knowledge	0.647534
Mimetic	
Normative	
RelAdv	0.747783
TMC	0.818594

Table 55: AVE Values

	Composite Reliability
#Employees	1
#ITStaff	1
Adoption	0.911594
Age	1
Coercive	
Compatibility	0.914936
Complexity	0.894909
Cost	0.92257
Knowledge	0.878219
Mimetic	
Normative	
RelAdv	0.898651
TMC	0.964341

Table 56: Composite Reliability

	#Employees	#ITStaff	Adoption	Age	Coercive	Compatibility	Complexity	Cost	Knowledge	Mimetic	Normative	RelAdv	TMC
#Employees	1												
#ITStaff	0.787051	1											
Adoption	0.061459	0.105321	1										
Age	0.617092	0.475431	-0.07689	1									
Coercive	0.135144	0.144363	0.561076	-0.014299	1								
Compatibility	0.040049	0.044149	0.559978	-0.112082	0.364447	1							
Complexity	0.028308	0.071801	-0.24776	0.14948	0.062713	-0.332715	1						
Cost	0.201293	0.263757	0.442885	-0.136228	0.380767	0.561642	-0.269714	1					
Knowledge	0.176103	0.233869	0.663154	-0.037086	0.386037	0.646754	-0.302	0.542505	1				
Mimetic	0.171982	0.171453	0.648466	0.007584	0.764717	0.447706	0.040849	0.413189	0.448765	1			
Normative	0.230695	0.255897	0.591908	0.056799	0.669204	0.354558	-0.013236	0.300469	0.424587	0.750014	1		
RelAdv	0.1327	0.098352	0.56105	-0.126064	0.463085	0.439229	-0.266128	0.489598	0.523744	0.425301	0.493613	1	
TMC	0.069579	0.13875	0.801333	-0.08222	0.575211	0.626062	-0.241962	0.539947	0.737193	0.600423	0.592018	0.665582	1

Table 57: Correlation Matrix