Trialability, perceived risk and complexity of understanding as determinants of cloud computing services adoption

Eugéne Etsebeth

11356384

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Abstract

In 2011 one-third of South African organisations did not intend to adopt cloud computing services because IT decision-maker lacked understanding of the related concepts and benefits (Goldstuck, 2011). This research develops a media-oriented model to examine the adoption of these services in South Africa. The model uses the technology acceptance model (TAM) and innovation diffusion theory (IDT) to develop variables that are considered determinants of adoption including trialability, complexity of understanding, perceived risk, perceived ease of use and perceived usefulness.

An electronic survey was sent to 107 IT decision-makers. Over 80% of the respondents were C-suite executives. The Partial Least Squares (PLS) method was chosen to depict and test the proposed model. PLS is superior to normal regression models and is a second generation technique. The data analysis included evaluating and modifying the model, assessing the new measurement model, testing the hypotheses of the model structure and presenting the structural model.

The research found that media, experts and word of mouth mitigate perceived risks including bandwidth, connectivity and power. Furthermore, trialability and perceived usefulness were affected by social influence, as well as influencing adoption. The results enable service providers and marketers to develop product roadmaps and pinpoint media messages.

Keywords

Cloud computing services, trialability, perceived risk, complexity of understanding, Partial Least Squares (PLS).

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Student name: Eugéne Etsebeth

Student signature:

Date of declaration:

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Chapter 1 : Introduction to the Research Problem

1.1 Research Title

Trialability, perceived risk and complexity of understanding as determinants of cloud computing services adoption.

1.2 Introduction

Arthur Goldstuck, the managing director of World Wide Worx, (IT-Online, 2011) stated that by 2013 only 56% of large South African companies would have adopted cloud computing, in one form or another. Some companies and small and medium enterprises (SME's) are realising the cost benefits in South Africa more quickly than others (IT-Online, 2011), but a major problem with cloud computing adoption is that the cloud computing services are a vaporous concept and some companies do not want to start considering it because of this complexity, but once started, companies immediately see the benefits (IT-Online, 2011).

Arthur Goldstuck (IT-Online, 2011) says that decision-makers are also not aware of what cloud computing can do for businesses mainly because they are not getting the correct information about the benefits in simple and understandable terms. An added confusion is that cloud computing as a model is not static and will need to be constantly revised. Wu, Lan and Lee (2011) comment that although many enterprise users acknowledge that there are benefits to cloud computing services adoption, there is a large lack of trust around data and network security.

Mell and Grance (2011) from the National Institute of Standards and Technology (NIST) have provided a definition to quell the debate and confusion that is in the public domain about "what is cloud computing"? Mell and Grance (2011) define cloud computing as a new business model that enables ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources including: applications, services, storage, servers and networks that can be quickly provisioned and released with minimal effort or service provider interaction.

Confusion and complexity are not the only problems facing South African and other developing countries organisations' adoption of cloud computing. Greengard (2010) in his article “Cloud Computing and Developing Nations” highlights a number of risks for developing countries including lack of connectivity, inadequate bandwidth and unpredictable electricity supplies.

Twinomugisha (2010) has lamented the lack of infrastructure in Africa which has resulted in high costs and low bandwidth. This lack of infrastructure in South Africa is apparent in electricity load-shedding activities and a subdued adoption of internet related activity. Mujinga and Chipangura (2011) add that the lack of infrastructure in South Africa exacerbates the data sovereignty issues and lack of control of an organization’s assets. Mujinga and Chipangura (2011) proffer that cloud computing services require higher internet bandwidth – to be able to access servers in Europe and the United States of America (USA).

The issues of data backups, privacy and security are universal and affect both cloud computing providers and enterprise users.

1.3 Research Motivation

The rationale behind this research is that there is a need for formal scientific research to study the factors underlying the adoption of cloud computing services because the adoption rate of cloud computing services by large organisations in South Africa is limited.

This research is important because it will lead to an increased understanding of the relationships of the determinants of adopting cloud computing services thereby allowing cloud computing service providers to better understand how to show consumers the value of their offering. This will assist service providers in shaping a marketing strategy, specifically attuned to South African business conditions.

In addition, cloud computing service providers will gain insights from the findings of this research allowing them to adjust their product road maps, or product releases. Consequently their product development strategy will align to the enterprise user market uptake.

Based on the research findings enterprise users of cloud computing services will be able to create a more accurate decision-making framework in preparation for the considerable adjustment to adopting cloud computing services in their organisations. This is especially true for the perceived risks that have hampered adoption in South Africa for cloud computing. These risks can be recalibrated by the enterprise users and mitigated in adoption strategies.

The IP EXPO Corporate Cloud Survey 2011 (Goldstuck, 2011) that was conducted in 2011 by World Wide Worx and was presented at the IP EXPO on 15 November 2011 gives evidence of the slow uptake and confusion around the cloud computing service offering in large South African companies.

1.3.1 Analysis of IP EXPO Corporate Cloud Survey 2011

The IP EXPO Corporate Cloud Survey 2011 (Goldstuck, 2011) is a survey that conducted research on 100 Johannesburg Stock Exchange (JSE) listed organisations with more than 200 employees. The interviews were done telephonically and took place with IT (information technology) decision-makers in the company.

The survey results for these South African corporations show:

- 54% do not use cloud computing in 2011
- 31% are not intending to use cloud computing by 2013
- 9% are considering cloud computing use by 2013
- 4% do not know if they will use cloud computing services by 2013

A number of findings were made from the survey:

- IT decision-makers are outside their comfort zone in understanding cloud computing
- There is a very low awareness of cloud computing definitions
- The reasons why 31% of South African corporations do not intend to adopt cloud computing are that they:
  - Do not see the benefits of cloud computing
  - Do not understand cloud computing
  - Are nervous about the cloud computing model

The summary of the findings (Goldstuck, 2011) indicate that the adoption of cloud computing in South Africa depends on the IT decision-makers being educated and well informed of the cloud computing services on offer. Another important finding was the fact that businesses must be able to build a business case for cloud computing adoption.

The questions that arise from this study are:

- If so many organisations are not intending to use cloud computing then what are the factors that can influence them to adopt these services?
- To what extent does the lack of understanding and complexity of understanding have on the adoption of cloud computing?
- Why are IT decision-makers nervous about cloud computing?
- What can cloud computing service providers and marketers do to educate and show the value of cloud computing to its business consumers?

1.4 Research Objectives

The research objectives of this study will be to look at the behavioural intent, or adoption, of cloud computing services in larger organisations in South Africa and to develop a proposed model which will include variables that other research has found related to adoption of cloud computing services and other technologies in other countries such as social influence, trialability, complexity of understanding, perceived risk, perceived ease of use and perceived usefulness.

In particular, the following constructs will be added (or amended) to an existing model by Wu (2011) in order to better understand the following determinants of cloud computing adoption:

- Social influence: How does social influence (mass media, expert opinions and word of mouth) affect the determinants of adoption of cloud computing services?
- Trialability: How does trialability of cloud computing services with its on-demand, pay-per-use and try-before-you-buy characteristics influence the adoption of these services?

- Complexity: What effect does lack of understanding, or complexity of understanding, have on the adoption of these services?
- Perceived risk: What effect does perceived risk in South Africa – as a developing country – have on the adoption of cloud computing services?

1.5 Problem Statement

Cloud computing service providers are failing to understand the societal influences (mass media, expert commentary and word of mouth) and determinants in South Africa that affect adoption of cloud computing services due to complexity of understanding and perceived risk (security, trust, bandwidth, connectivity and power availability), even although the nature of the services encourages trialability, and the cloud offerings are perceived to be useful and easy to use.

Previous research has identified key variables of cloud computing services and other technology adoption. However, the relevance of these variables to the slow uptake rate of cloud computing services is unknown in corporate South Africa. An explanatory model of the determinants of cloud computing services would highlight the barriers and correlates of cloud computing adoption by corporates in South Africa.

The purpose of this research is to develop and test a proposed model which will include variables such as trialability, perceived risk and complexity of understanding, in an attempt to make the model more relevant to the cloud computing market place and allow a greater prediction of conditions for usage of cloud computing services, especially for large South African organisations.

1.6 Research Scope

The scope of the research is described by the following definitions:

- Large South African organisations will be defined as follows:
  - Organisations with more than 150 employees, excluding public sector organisations.
- Information technology decision-makers will include:
  - Chief information officers (CIO), chief technology officers (CTO), chief executive officers (CEO), IT directors or IT managers.

- Cloud computing services adoption is a term to define the behavioural intent of IT decision-makers to use or adopt cloud computing services
- Trialability refers to the ability to try or experiment with the performance of cloud computing services on a limited basis, with the benefits of characteristics of on demand, pay-per-use and try-before-you-buy. Trialability acts as a proxy to behavioural intent, or adoption.
- Complexity of understanding refers to the level of difficulty in understanding cloud computing services and the barriers this creates in adopting cloud computing services.
- Perceived risk is made up of five facets of risk including financial, performance, privacy, psychological and time risk (Cunningham, 1967).
- The proposed model refers to theoretical model hypothesized by the researcher to depict relationships between the following constructs: social influence, trialability, complexity of understanding, perceived risk, perceived ease of use, perceived usefulness and behavioural intent.
- The proposed model is based on the adoption model by Wu (2011), which has the technology acceptance model (TAM) (Davis, 1989) at its core.

This proposed model and its theoretical foundations are discussed in the following chapter.

Chapter 2 : The Research Model and its Theoretical Foundations

2.1 Introduction

The theory that was reviewed in this section is undertaken with the purpose of building a theoretical model. The subsequent sections specify the theoretical foundation of the proposed model by discussing the concept of cloud computing, TAM, IDT, social influence, trialability, complexity of understanding, perceived risk and culminates in the creation of the proposed model in Chapter 3.

2.2 The Concept of Cloud Computing and Cloud Computing Services

Computing is undergoing a transformation whereby users consume services shaped to custom requirements only when they need them. Cloud computing opens the door to new business models that allow a user to forego much of the capital outlay for computer hardware and software. This business model incentivizes cloud service providers to make profits by charging consumers for accessing these services and consumers with the opportunity to reduce or eliminate costs associated with ‘‘in-house’’ provision of these services (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009). Wu (2011) also identified cloud services as a burgeoning business model that offers ways of delivering and applying computing services via IT.

This commoditised computing business model has become known as the cloud, or cloud computing. In order to define cloud computing it is important to understand that cloud computing has been built on existing technology. Youseff, Butrico and Da Silva (2008) understood that cloud computing has borrowed its basics from several other computing areas and systems engineering concepts including cluster computing, grid, peer-to-peer (P2P) and service oriented architecture (SOA). These are terms that are often confused with cloud computing.

There have been many definitions of cloud computing that have been proposed in order to encapsulate the complex term of cloud computing. Erdogmus (2009) describes cloud computing as a pool of highly scalable, abstracted infrastructure that bills based on consumption and is capable of hosting end-customer applications. Coombe (2009) defines cloud computing as a paradigm shift that facilitates scalable processing and storage over distributed, networked machines that are commoditised.

Buyya et al. (2009) describe a cloud as a type of parallel and distributed system consisting of a group of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the consumers and service provider. Sultan (2009) considers cloud computing to be IT capabilities that are requested, provisioned, delivered, and consumed in real time over the internet.

There is a misconception that accessing data across the Internet and cloud computing are the same. Buyya et al. (2009) clarifies that it is common to access content across the Internet independently without reference to the underlying hosting infrastructure, however cloud computing is an extension of this model wherein the capabilities of business applications are exposed as sophisticated services that can be accessed and delivered over a network.

Feuerlicht (2010) states that cloud services free up organisations to concentrate on core business activities and implement applications that deliver a competitive advantage. Organisations may also need to adopt different forms of cloud computing depending on their risk portfolio because of security or regulatory reasons. Goscinski and Brock (2010) emphasise that cloud computing will be adopted by organisations that are likely to use a more hybrid process of on-premise, “public” cloud and “private” cloud services when appropriate.

These forms are described below:

- Public cloud – cloud computing is outsourced
- Private cloud – cloud computing is insourced
- Hybrid – cloud computing is made up of a combination or insourced and outsourced

It is essential to note the difference in the terms cloud computing and cloud services. Wu et al. (2011) elucidate this subtle distinction between cloud computing and cloud services by stating that cloud services can be viewed as a cluster of service solutions – based on cloud computing.

Mell and Grance (2011) from the National Institute of Standards and Technology (NIST) have defined three cloud computing service models, based on cloud computing, that have been recognised thus far:

1) Software as a Service (SaaS) – allows access to provider offered applications via thin-client interfaces (Mell & Grance, 2011), an example is SaleForce.com;
2) Platform as a Service (PaaS) – offers capability to the consumer to deploy consumer made or purchased applications created using programming languages and tools supported by the provider (Mell & Grance, 2011), an example is Google's App Engine;
3) Infrastructure as a Service (IaaS) – offers the capability to provide to the consumer provisioning of processing, storage, networks where the consumer is able to deploy and run software, including operating systems and applications (Mell & Grance, 2011) - examples include Amazon's Elastic Compute Cloud (EC2) and Simple Storage Service (S3).

Yoeuseff et al. (2008) explain that the current state of cloud computing research lacks the understanding of the classification of the cloud systems, their correlation and inter-dependency while obscurity is hindering the advancement of this research field. Yoeuseff et al. (2008) sought to identify a cloud computing ontology that consists of six services. This ontology has three more than NIST, except with the additional services of Hardware as a Service (HaaS), Data Storage as a Service (DaaS) and Communication as a Service (CaaS) layer, over and above SaaS, PaaS and IaaS.

1) HaaS - provider operates manages and upgrades the hardware on behalf of its consumers, for the life-time of the sublease;
2) DaaS - it facilitates cloud applications to scale beyond their limited servers;
3) CaaS - emerged to support such requirements as network security, dynamic provisioning of virtual overlays for traffic isolation or dedicated bandwidth, guaranteed message delay, communication encryption and network monitoring. An example is Microsoft Connected Service Framework (CSF).

A comprehensive cloud computing ontology still needs to be bedded down. Nevertheless, business users and individual consumers around the world can consume these services without having to run them on their own computers. This is why cloud computing is being compared to a commodity. Buyya et al. (2009) have presented cloud computing as the 5th utility, along with water, electricity, gas and telephony.

This paradigm shift to cloud computing and the commoditisation of computing have fundamentally changed the way enterprise users comprehend IT. Understandably organisations will take stock and fathom what cloud computing means for their organisations.

TAM has become a widely used model to explain the adoption of technological products and services. TAM is explained in more detail in the next section and was used as part of the proposed model to better understand how enterprise users are adopting cloud computing and their related cloud computing services.

2.3 Technology Acceptance Model

Davis (1989) introduced TAM to explain a potential user's behavioural intention to use a technological innovation. TAM (Figure 1) is based on Fishbein and Ajzen's (1975) theory of reasoned action (TRA) which was drawn from social psychology and focused on attitudes to human behaviour and subjective norms.

Davis (1989) defined perceived usefulness as the degrees to how a person believes using a system would enhance their job performance, and perceived ease of use was defined as how the same person believes that using the same system would be without effort. Lee, Li, Yen and Huang (2010) confirmed that at the core of TAM, behavioural intention is affected by perceived usefulness, perceived ease of use and perceived usefulness is affected by perceived ease of use.

These widely used TAM relationships are depicted in Figure 1 and are omnipresent in associated models attempting to explain technology adoption and behavioural intent.

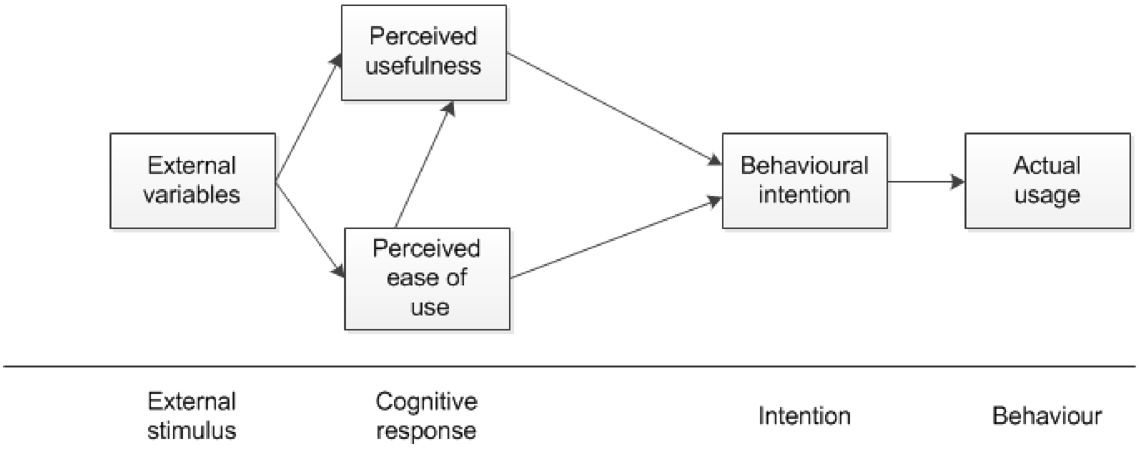

Figure 1: Technology Acceptance Model (TAM) (Source: Venkatesh and Davis, 1996)

The appeal of using TAM is not without reason. Lee (2009) suggests that the attractiveness of using the TAM model lies in that it is both parsimonious and specific and that it displays a high level of prediction power of technology use.

King and He (2006) state that although TAM is imperfect and all relationships are not relevant in all studies it is a valid and robust model. Wu (2011) emphasises that TAM and the modified versions of TAM shown in Table 1 focus on understanding the employees new technology adoption, rather than trying to ascertain the determinants of managerial decision making in terms of new technology adoption.

Table 1: Summary of TAM and Modified Version Aims

TAM and modified versions	Model Aims	Source
TAM	TAM was designed to comprehend the causal chain connecting external variables to its user acceptance and actual use in an organisation. TAM assists in understanding of the antecedents of perceived ease of use.	(Venkatesh & Davis, 1996)
TAM2	TAM2 aims to understand perceived usefulness to be able to design workplace interventions that would augment user acceptance of new systems	(Venkatesh & Davis, 2000)
UTAUT	Unified technology acceptance model (UTAUT) builds a unified model as a useful tool for managers needing to measure the likelihood of success for new technology introductions.	(Venkatesh, Morris, Davis, & Davis, 2003)
TAM3	TAM3 presents an integrated model with importance placed on perceived usefulness and perceived ease of use in order to address how managers and decision-makers make informed decisions about interventions.	(Venkatesh & Bala, 2008)

Wu (2011) also notes that TAM and its modified versions (TAM2, UTAUT and TAM3) are not suitable for all applications because they omit key constructs like perceived risk. For this reason TAM has also become an accepted model that can be extended and modified (López-Nicolás, Molina-Castillo, & Bouwman, 2008; Masinge, 2010; Wu W. , 2011). The model that is proposed in this study adds to TAM by selecting relevant constructs from the modified versions of TAM as well as other models and constructs.

The significance of TAM is not overlooked in this study and it forms the core of the proposed model. King and He (2006) in their meta-analysis of TAM concurred that TAM involved two primary predictors - perceived ease of use and perceived usefulness, and the dependant variable behavioural intention, which according to TRA is assumed to be strongly related to actual behaviour. Wu (2011) in their study on

SaaS adoption found significant positive effects of perceived ease of use and perceived usefulness on behavioural intent.

TAM forms the basis of the proposed model. The relational links between variables that were posited from this section of theory are:

- Perceived usefulness has a positive effect on behavioural intent
- Perceived ease of use has a positive effect on behavioural intent
- Perceived ease of use has a positive effect on perceived usefulness

For the purpose of this study, perceived usefulness, perceived ease of use and behavioural intent formed the core of the proposed model.

2.4 Diffusion of Innovation

Rogers (1995) proposed Innovation Diffusion Theory (IDT) with one of the major tenets being the diffusion process. Rogers (1995) diffusion process describes the characteristics of an innovation – as perceived by the members of a social system – that determine its rate of adoption.

Rogers (1995) indicates that communication channels, or structure, are the means by which members of the social system get messages from one person to another. These channels take the form of:

- Mass media - These channels are more effective in producing knowledge of innovations
- Inter-personal – These channels are more effective in forming and changing attitudes toward a new idea, and thus in influencing the decision to adopt or reject a new idea.

Rogers (1995) states most individuals appraise an innovation through the subjective evaluations of near peers who have adopted the innovation and not on the basis of scientific research by experts. Importantly Rogers (1995) recognised that the social influence and communication structure of a system can speed up, or slow down, the diffusion of innovations in a system.

Rogers (1995) defined five significant attributes that determine an innovations rate, or speed of adoption:

1) Relative advantage – the degree to which an innovation is perceived as better than its predecessor;
2) Compatibility – the degree to which an innovation is perceived consistent with the existing values, needs and experiences of potential adopters;
3) Complexity – the degree to which an innovation is perceived as being difficult to use or understand;
4) Trialability – the degree to which an innovation may be experimented with before potential adoption;
5) Observability – the degree to which the results of an innovation are visible to other people.

According to Rogers (1995) these characteristics can be used to describe innovation and recommends that the measures of the five perceived attributes should be developed in each diffusion study, rather than using existing scales from previous studies. Wu and Wang (2005) state that TAM and IDT are similar in some constructs and if integrated may provide a stronger model than either standing alone.

The theory recommends and encourages the integration of TAM and IDT. The relational link between variables that were posited from the theory is:

- Perceived usefulness (TAM) has a positive effect on trialability (IDT)

Rogers (1995) acknowledges that time is involved in innovation diffusion. Rogers (1995) suggests that diffusion is a process whereby an innovation is communicated through certain channels, over time, among members of a social system. The innovation decision process – of which time is the major dimension - is the process through which an individual passes from obtaining first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. An innovation, or technology like cloud computing services, may be at a different stage in the innovation diffusion process.

For the purpose of this study TAM and components of IDT were combined to supplement and improve the proposed model.

2.5 Social Influence

Society has a strong influence on individual decision-making whether it be in a family, peer group or business environment. Our behaviours, attitudes and perceptions are influenced by stimuli and information from our social surroundings. Societal influences also have an effect on the adoption of technologies. The TAM model, discussed in a previous section, was extended by Venkatesh and Davis (2000) into an updated TAM model called TAM2 (Figure 2). In TAM2 social influence is added as a direct determinant of behavioural intention and is represented as a subjective norm in TAM2 (Venkatesh, Morris, Davis, & Davis, 2003).

The relational link between variables that were posited from the theory that recommends and encourages the integration of TAM and IDT are:

- Social influence (TAM2) has a negative effect on complexity of understanding (IDT)
- Social influence (TAM2) has a positive effect on trialability (IDT)

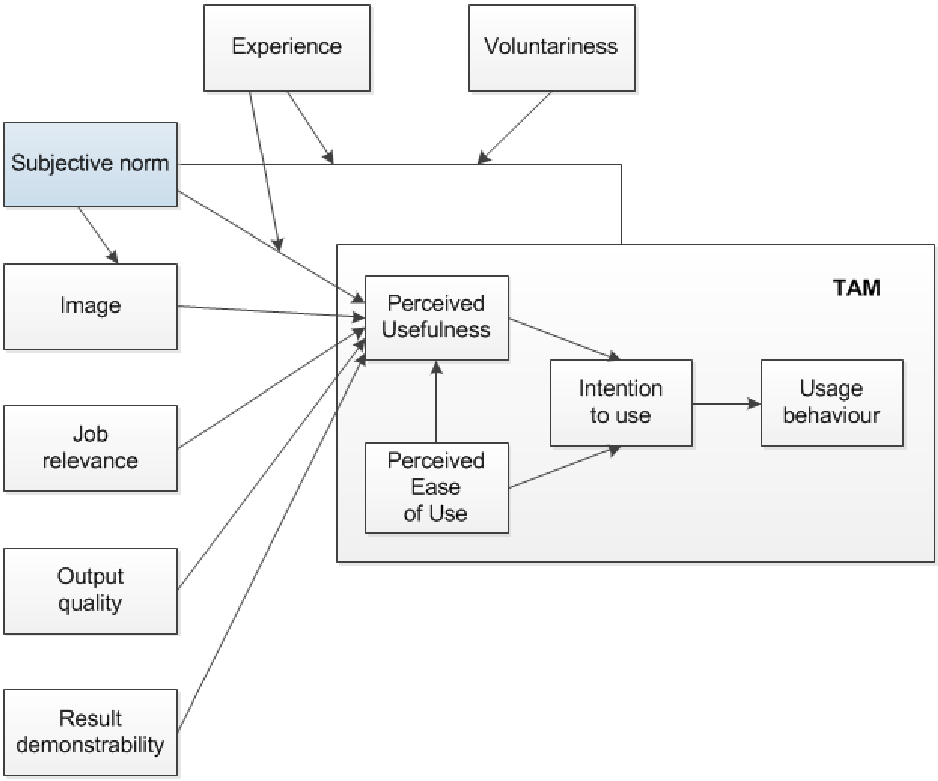

Figure 2: Extension of the Technology Acceptance Model (TAM2) (Source: Venkatesh and Davis, 2000)

The subjective norm is drawn from social psychology and was used by Fishbein and Ajzen's in their TRA theory, wherein they postulated that a subjective norm is the individual's perception of how his behaviour will be influenced by important people around him (1975).

In UTAUT, social influence uses TRA theory to define social influence from a technology perspective. Social influence is defined as the extent to which a decision-maker perceives that important others believe he or she should use the new technology or system (Venkatesh, Morris, Davis, & Davis, 2003).

In a study about email adoption and usage by Karahanna and Straub (1999) they state that both perceived usefuleness and perceived ease of use will be affected by social influence. It was found that perceived usefuleness was determined by social influence, above all other constructs.

The relational link between variables that were posited from this section of theory is:

- Social influence (TAM2) has a positive effect on perceived usefulness (TAM)

Karahanna and Straub (1999) suggests that social influence may be operating via the internalization mechanism which produces a long lasting form of attitude change. It would be fitting, at this point, to introduce the social influence mechanisms that UTAUT state may impact that individual decision-making behaviour namely: compliance, internalization and identification.

The compliance mechanism causes an individual to change their intention in response to the social pressure. Internalisation and identification relate to altering an individual's belief structure and/or causing an individual to respond to potential social status gains.

Karahanna and Straub (1999) state that initially compliance and internalization processes may occur in email adoption, however, as perceived usefuleness about email became integrated into the user's cognitive belief system, the influence of compliance is likely to decrease over time.

Social influence has also been used by López-Nicolás et al. (2008) to assess mobile services acceptance. López-Nicolás et al. (2008) state that potential new users of technologies are exposed to informal social networks including mass media, experts and word of mouth, in which opinions, decisions and behavioural intent may be affected.

López-Nicolás et al. (2008) found in their study on advanced mobile services that social factors affect peoples' decisions to adopt the technology and the opinions of friends, family and mass exerted a significant impact. López-Nicolás et al. (2008) found that social influence has a positive impact on the perceived ease of use of technology.

The relational link between variables that were posited from this section of theory is:

- Social influence (TAM2) has a positive effect on perceived ease of use (TAM)

Wu (2011) study on SaaS adoption adds credence to this finding by identifying that social influence has a postive affect on perceive usefuleness as well as perceived ease of use. In the same study Wu (2011) found that social influence has a postive relationship between security and trust.

Slovic (1987) stated that risks are subjectively defined by individuals who may be influenced by a wide array of social, psychological, institutional and cultural factors.

The relational link between variables that were posited from this section of theory is:

- Social influence (TAM2) has a negative effect on perceived risk

For the purpose of this study, social influence was a precedent to trialability, complexity of understanding, perceived usefulness, perceived ease of use and perceived risk.

2.6 Trialability

The suggestion that a new product should be trialed before it is purchased or adopted was introduced by Ram (1987) in his model of innovation resistance. Trialability is a form of partial adoption and as such is treated as a proxy of behavioural intent.

Trialability is part of IDT and is defined as the ability to try or experiment with the performance of new technology on a limited basis (Rogers, 1995). An innovation that can be tested by a consumer in their own conditions (high trialability) is more likely to be adopted than an innovation that does not have trialability (Rogers, 1995).

Wu (2011) states that cloud services is a ground breaking alternative enabling organisations to pay only for what they use with regard to computing and networking resources. Klems, Nimis and Tai (2009) indicate that cloud computing services offer organisations the ability to rent services on a pay-per-use basis. According to Feuerlicht (2010) cloud services can be rented by organisations on a pay-as-you-use basis enabling them to adjust the services usage according to their current needs and select manifold service providers, instead of being locked into one.

Johnson (2008) argued that consumers' motivation needs to be incentivised by offering trialability of the innovations because the immediate benefits to enterprise end users are not directly apparent. The adoption of cell phone and smart phone technology has had multiple studies conducted to understand the effects of trialability. Brown, Cajee, Davies and Stroebel (2003) investigated that if trialability in South Africa was not evident in cell phone banking adoption that this acted as an obstacle to acceptance of the technology.

According to Chung and Kwon (2009) trialability is perceived to be more significant for early adopters, as well as influencing early adopter decision-making attitudes. Chen, Yen and Chen (2009) found that there was significant impact on the attitude to adopt a technology when consumers can test and find compatibility with their instant tasks.

The relational links between variables that were posited from this section of theory and the IDT section is:

- Trialability (IDT) has a positive effect on behavioural intent (TAM)

Trialability is a characteristic of cloud computing services and its potential has not been fully recognised as a determinant of adoption of cloud services. For this study, trialability was included in the proposed model as an antecedent of behavioural intent.

2.7 Complexity of Understanding

Complexity was defined as the level of difficulty in:

1) Understanding; and
2) Using the technology (Rogers, 1995).

There is a potential duplication of constructs between perceived ease of use and the second part of Roger's (1995) definition which relates to the level of difficulty in "using" a technology. Taylor and Todd (1995) state that complexity is analogous (although in the opposite direction) to the ease of use construct in TAM. However, Rogers (1995) was specific in identifying complexity as a hybrid of understanding and use.

Wakeland (2007) depicts a type of complexity that could be considered in this study as two proposed frames of reference for technological innovations 1) Complexity described as the interactions between a human and a technological system, 2) Complexity of the interaction between components of the system. Both these frames of reference are concentrated on complexity of use of the human and system, or of the system itself.

Wakeland (2007) proposes a frame of reference that can be interpreted as either complexity of use, or complexity of understanding. However, in this study complexity will be defined solely as the level of difficulty in understanding the technology – which may lead to a lack of understanding of the cloud computing services.

Greifeneder, Scheibehenne and Kleder (2010) explored Wakeland's complexity between a human and system reference and showed that by multiplying cell phone banking products complexity will increase.

In a previous study on electronic data interchange (EDI) Premkumar, Ramamurthy and Nilakanta used the complexity of understanding as an innovation construct and established that it can become a barrier to adopting a new technology (1994).

Low, Chen and Wu (2011) say that it may take users a long time to understand and implement the new system. Youseff et al. (2008) stated several business models rapidly evolved to harness this technology by providing software applications, programming platforms, data-storage, computing infrastructure and hardware as services and while they refer to the core cloud computing services, their inter-relations have been ambiguous and the feasibility of enabling their inter-operability has been debatable.

Youseff et al. (2008) research endeavoured towards an end-goal of a thorough comprehension of the field of cloud computing, and a more rapid adoption by describing an ontology of cloud computing. Premkumar et al. (1994) state that complexity of innovations may act as a barrier to implementation of new technology; complexity factor is usually negatively affected.

The relational links between variables that were posited from this section of theory and the trialability section are:

- Complexity of understanding (IDT) has a negative effect on behavioural intent (TAM)
- Complexity of understanding (IDT) has a negative effect on trialability (IDT)

For the purpose of this study, complexity of understanding was included in the proposed model as an antecedent of behavioural intent and an antecedent of trialability.

2.8 Perceived Risk

Risk is crucial in assessing a new technology mainly because of the uncertainty that adoption may bring – and the resultant financial impacts. Bauer (1967) in his seminal work defined perceived risk as a concoction of uncertainty and seriousness of outcome involved. Featherman and Pavlou (2003) state that perceived risk is frequently defined as a felt uncertainty regarding possible negative consequences of using a product or service. According to Yiu, Grant and Edgar (2007) perceived risk is defined as the subjective expectation of a customer suffering a loss when performing a specific task or action.

Featherman and Wells (2010) noted that risk causes individual decision-making, especially when the decision may have adverse consequences over which the individual has no control. According to Wu et al. (2011) when users have a lack of knowledge, or low self-confidence in a vulnerable and risky situation trust is especially important to mitigate perceived risks.

Cloud computing is not impervious to the many risks associated with adoption. Subashini and Kavitha (2011) highlighted that when SaaS adoption is being considered then security and privacy elements should be included like data security, network security, data locality, integrity, segregation, data access, authentication, availability and backup. According to Wu et al. (2011) in their study on SaaS adoption the main concerns of cloud services include privacy, availability of services or performance, integrity of services and data confidentiality.

Benlian and Hess (2011) assessed the perceived risk of IT executives in adopting SaaS and found that the major risk factors driving SaaS adoption intentions were security risks, followed by performance and economic risks. According to Subashini and Kavitha (2011) users are apprehensive to financial and privacy risks in the cloud services availability that could lead to loss of sensitive data and money.

It is apparent that there are multiple risks that confront users adopting cloud computing. Luo, Zhang and Shim (2010) highlighted the importance of multi-faceted risk perceptions when considering a construct for innovation adoption. Therefore, using this recommendation the construct of perceived risk will be a combination of multiple facets.

Cunningham (1967) typified perceived risk as having six dimensions performance, financial, time, safety, social and psychological loss. Many researchers have used these six basic dimensions in their studies (Benlian & Hess, 2011; Featherman & Pavlou, 2003).

Perceived risk will be explored were using the following six facets Cunningham (1967):

1) Financial risk – the potential for financial loss of using the cloud computing services
2) Performance risk – this refers to the possibility of the cloud computing services not performing as expected. Gewald and Dibbern (2009) explain that performance risk does not provide application availability and network bandwidth as the provider originally stipulated
3) Privacy risk – this refers to the potential loss of personal information due to using cloud computing services
4) Psychological risk – this refers to the enterprise users assessment of potential loss to consumer “peace of mind” or self-perception by using cloud computing services
5) Social risk – this is the risk that using cloud computing services may result in a loss of status in the enterprise users social group
6) Time risk – This refers to the loss of the time, effort and the inconvenience incurred by using cloud computing services

This study, in line with previous studies has modelled perceived risk as a single construct (Brown et al., 2003; Tan & Teo, 2000). To support the use of the six facets of perceived risk it was evident in the studies taken by Lee (2009) that risks of security, financial, time, social and performance, emerged as negative factors in the intention to adopt online banking.

Lee (2009) acknowledges that it is important that social risk was found to have an insignificant effect on the intention to adopt online banking. The construct of social influence is already being utilised in the proposed model and it is proposed that social influence has a negative effect on perceived risk. When transferring the framework to computing adoption the risk called social risk, although embedded in the proposed model, will not explicitly form part of the perceived risk construct.

Perceived risks have been used in various studies to support that risks negatively affect adoption. In an Internet banking study by Tan and Teo (2000) they revealed that perceived risk is a significant determinant of adoption. Brown et al. (2003) applied Tan and Teo (2000) Internet banking adoption framework to the mobile banking context and found perceived risks to be significant factors affecting mobile banking adoption. Wu et al. (2011) found that perceived risks acted as barriers to SaaS adoption.

The relational link between variables that were posited from this section of theory is:

- Perceived risk has a negative effect on behavioural intent (TAM)

For this study, the five facets (excluding social risk) of perceived risk were considered as one construct and this construct was included in the proposed model as an antecedent of behavioural intent.

2.9 Conclusion to Literature Review

The literature shows that social influence in the form of mass media, expert opinions and word of mouth affects the determinants of adoption of cloud computing services. The influence that society wields may have an ability to make previously complex technologies become more mainstream, encourage technology laggards to experiment with new technologies, change perceptions around the usage and usefulness of cloud computing services and may also impact perceived risks about cloud computing services adoption.

An IT decision-maker is influenced constantly by stimuli including social, psychological, institutional and cultural factors. The research model, although theoretical underpinned, would be incomplete if it did not include this powerful social influencer on the determinants of adoption.

The potential that IT decision-makers may lack the understanding because of complexity and confusing technology standards is likely to affect the uptake of cloud computing services. The adoption rate may be accelerated by having the characteristic of trialability for cloud computing services. Trialability may be affected by complexity of understanding cloud computing services, because trialability encourages experimentation and may be considered a proxy for behavioural intent.

In a developing country like South Africa with security, trust, bandwidth, connectivity and power availability problems, the risks of providing cloud computing services may slow down the IT decision-maker from implementing these services because the business risks are too high.

These variables that may determine the adoption of cloud computing services have been selected and constructed specifically for the South African environment. The variables are based on technology adoption literature and concentrate on cloud computing characteristics of technology. The combining of IDT and TAM, although previously attempted, has led to the research model having some exploratory aspects.

The related variables in Table 2 are used to formulate the hypotheses in the next chapter. The research model is also assembled in the following chapter, based on these variables and the resultant hypotheses. Additional theory is used in developing the proposed adoption model in Chapter 3.

Table 2: Consistency Matrix

Variable	Effect	Predicted Variable	Literature Review
Social Influence	-	Complexity of understanding	Rogers (1995), Wu and Wang (2005)
	+	Trialability	Rogers (1995), Wu and Wang (2005)
	+	Perceived usefulness	(Venkatesh, Morris, Davis, & Davis, 2003), Karahanna and Straub (1999), Wu (2011)
	+	Perceived ease of use	(Venkatesh, Morris, Davis, & Davis, 2003), Karahanna and Straub (1999), López-Nicolás et al. (2008), Wu (2011)
	-	Perceived risk	Slovic (1987), Wu (2011)
Complexity of Understanding	-	Trialability	Premkumar et al. (1994) , Rogers (1995), Low et al. (2011)
	-	Behavioural intent	Premkumar et al. (1994) , Rogers (1995), Low et al. (2011)
Perceived Usefulness	+	Trialability	Rogers (1995), Wu and Wang (2005)
	+	Behavioural intent	Davis (1989), Venkatesh and Davis (1996), King and He (2006), Wu (2011), Lee et al. (2010)
Perceived Ease of Use	+	Perceived usefulness	Davis (1989), Venkatesh and Davis, 1996), King and He (2006), Lee et al. (2010)
	+	Behavioural intent	Davis (1989), Venkatesh and Davis, 1996); King and He (2006), Wu (2011), Lee et al. (2010)
Trialability	+	Behavioural intent	(Rogers, 1995), Johnson (2008), Chung and Kwon (2009), Yen and Chen (2009)
Perceived Risk	-	Behavioural intent	Cunningham (1967), Tan and Teo (2000), Benlian and Hess (2011), Wu et al. (2011)

Chapter 3 : Developing a Proposed Adoption Model

In order to develop the proposed model based on the variables in the previous chapter, some theory will be reviewed in the subsequent section. After the adoption model theory is proposed, the hypotheses are stated, followed by the presentation of the proposed model.

3.1 Proposed Adoption Model Theory

King and He (2006) compiled 88 TAM empirical studies to establish a meta-analysis of TAM and found TAM to be a powerful and robust predictive model. King and He (2006) found that four kinds of modifications have contributed to the growth of TAM as a model:

1) Changing external antecedents
2) Changing predictive variables
3) Manipulating moderating variables
4) Varying the consequence measures

The most important constructs are behavioural intent, perceived usefulness and perceived ease of use because they formed the core of the model.

Three of the four categories of modifications in Figure 3 are utilised in the proposed model:

1) Social influence may be considered a prior factor.
2) Trialability and complexity of understanding are factors that have been proposed from IDT theory.
3) Perceived risks for developing countries may be categorised as contextual factors.

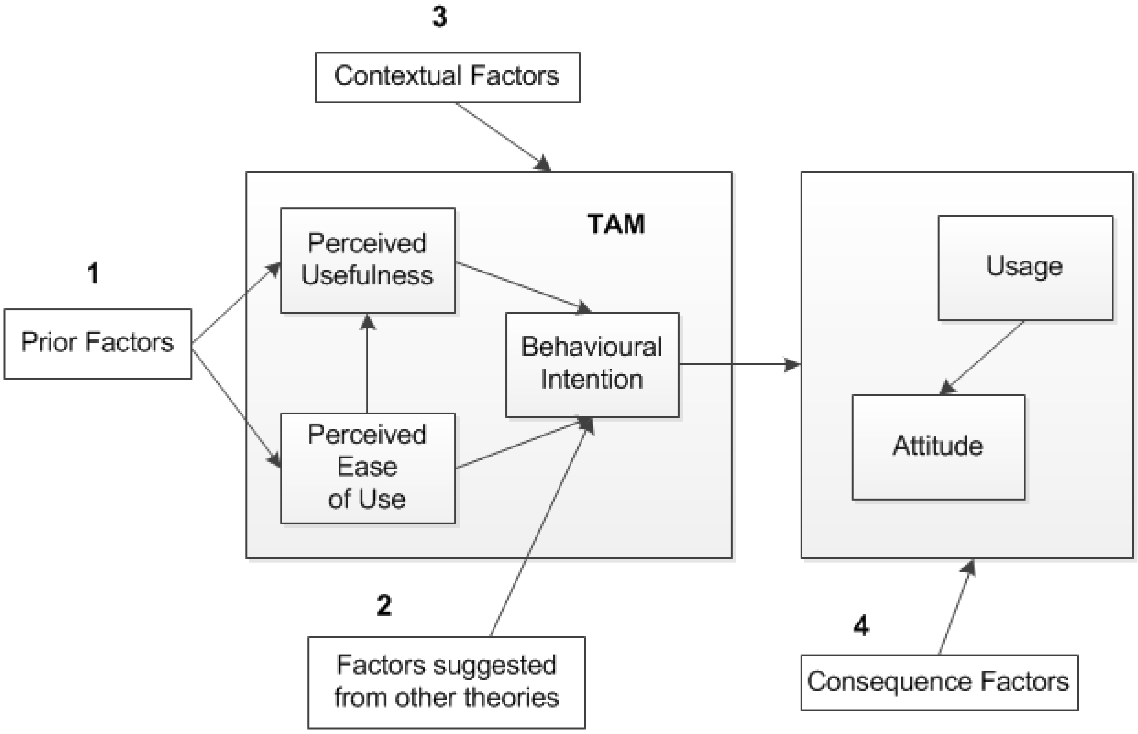

Figure 3: TAM and Four Categories of Modifications (Source: King and He, 2006)

One such example of a modification was when IDT was combined with TAM2 by Wu and Wang (2005) to describe the drivers of mobile commerce. Another recently proposed model by López-Nicolás et al. includes eight constructs: media influence, social influence, perceived status benefits, perceived flexibility benefits, attitude towards mobile innovations, behavioural intent, perceived usefulness and perceived ease of use (2008).

More, recently Wu (2011) has used this model of López-Nicolás et al. in order to develop an explorative model for SaaS adoption. Wu (2011) states that with the combination of IDT and TAM:

1) The model is simpler to use in moderating variables than TAM
2) Social influence affects all constructs
3) The model is viewed as a media-oriented model, highlighting technology acceptance by a decision-making employee in the workplace

For the purposes of this study a research model stemming from the model based on the TAM and IDT model proposed by López-Nicolás et al., 2008. The adjusted SaaS model of Wu (2011) will be proposed and tested using only South African organisations. At the core are the original determinants of TAM: behavioural intent, perceived usefulness and perceived ease of use. Additional determinants will be five facets of perceived risk (combined into one construct), trialability and complexity of understanding.

The proposed model of cloud computing adoption is described below and presented in Figure 5:

1) To add to a model (Figure 4) by López-Nicolás et al. (2008) and Wu (2011) explaining the effects of:
    a. Trialability on behavioural intent
    b. Complexity of understanding on behavioural intent and trialability
2) To moderate the existing model by explaining the effects of:
    a. Social influence on complexity of understanding
    b. Social influence on trialability
3) To moderate the existing model of Wu (2011) by altering the construct of:
    a. Security and trust to perceived risk
4) To moderate the existing model of Wu (2011) by removing the construct of:
    a. Attitude towards technology innovations
    b. Market effort
    c. Perceived benefits

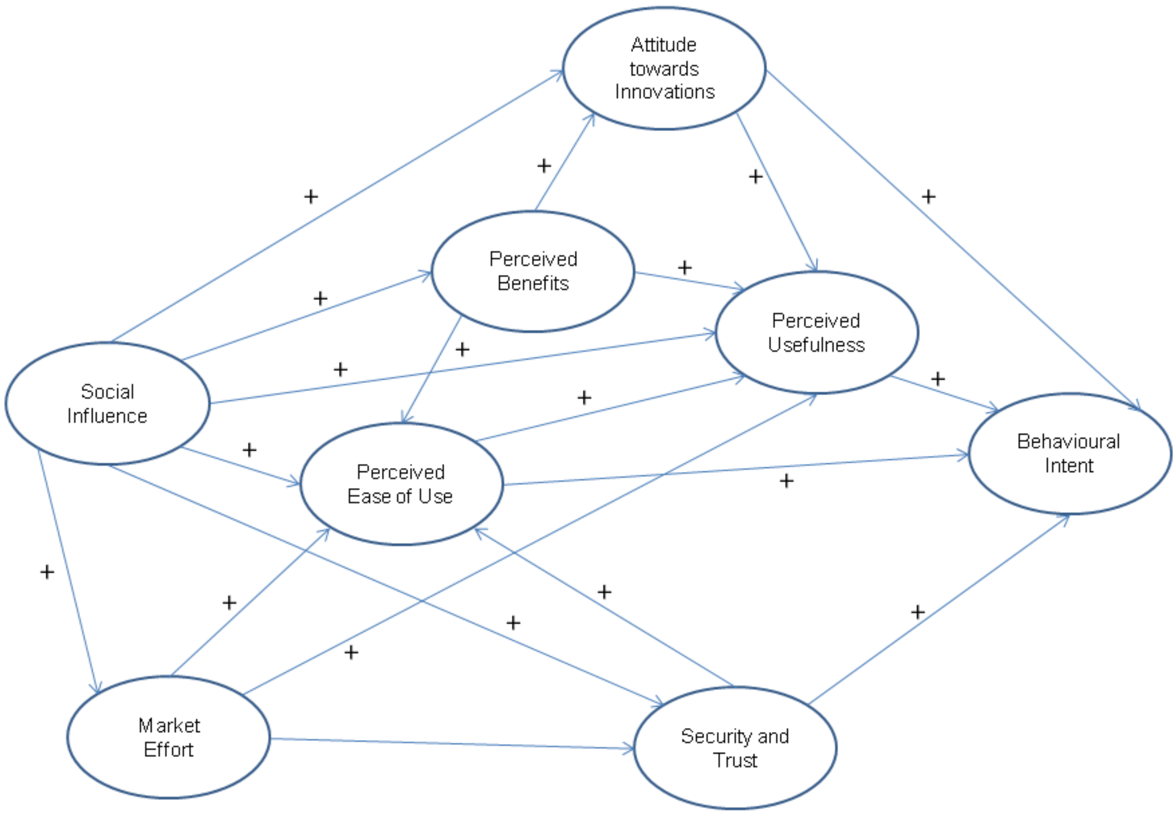

Figure 4: Theoretical Model of Adoption (Adapted from López-Nicolás et al. (2008) and Wu (2011))

3.2 Hypotheses

Each of the relational links in the proposed model (Figure 5) may thus be formulated as the following hypotheses.

H_1: Social influence has a direct negative effect on complexity of understanding

H_2: Social influence has a direct positive effect on trialability

H_3: Social influence has a direct positive effect on perceived usefulness

H_4: Social influence has a direct positive effect on perceived ease of use

H_5: Social influence has a direct negative effect on perceived risk

H_6: Complexity of understanding has a direct negative effect on trialability

H_7: Perceived usefulness has a direct positive effect on trialability

H_8: Perceived ease of use has a direct positive effect on perceived usefulness

H_9: Trialability has a direct positive effect on behavioural intent

H_{10}: Complexity of understanding has a direct negative effect on behavioural intent

H_{11}: Perceived usefulness has a direct positive effect on behavioural intent

H_{12}: Perceived ease of use has a direct positive effect on behavioural intent
H_{13}: Perceived risk has a direct negative effect on behavioural intent

It should be noted that the corresponding statistical null hypotheses would be stated in null (non-relational) form. These hypotheses are tested statistically in Chapter 5.

$H0_1$: Social influence has no effect on complexity of understanding
$H0_2$: Social influence has no effect on trialability
$H0_3$: Social influence has no effect on perceived usefulness
$H0_4$: Social influence has no effect on perceived ease of use
$H0_5$: Social influence has no effect on perceived risk
$H0_6$: Complexity of understanding has no effect on trialability
$H0_7$: Perceived usefulness has no effect on trialability
$H0_8$: Perceived ease of use has no effect on perceived usefulness
$H0_9$: Trialability has no effect on behavioural intent
$H0_{10}$: Complexity of understanding has no effect on behavioural intent
$H0_{11}$: Perceived usefulness has no effect on behavioural intent
$H0_{12}$: Perceived ease of use has no effect on behavioural intent
$H0_{13}$: Perceived risk has no effect on behavioural intent

3.3 The Proposed Model

The proposed extended adoption model thus includes seven latent variables representing each construct, one of which is exogenous (social influence). The proposed model – with the main constructs of trialability, perceived risk and complexity of understanding highlighted – is given in Figure 5 below.

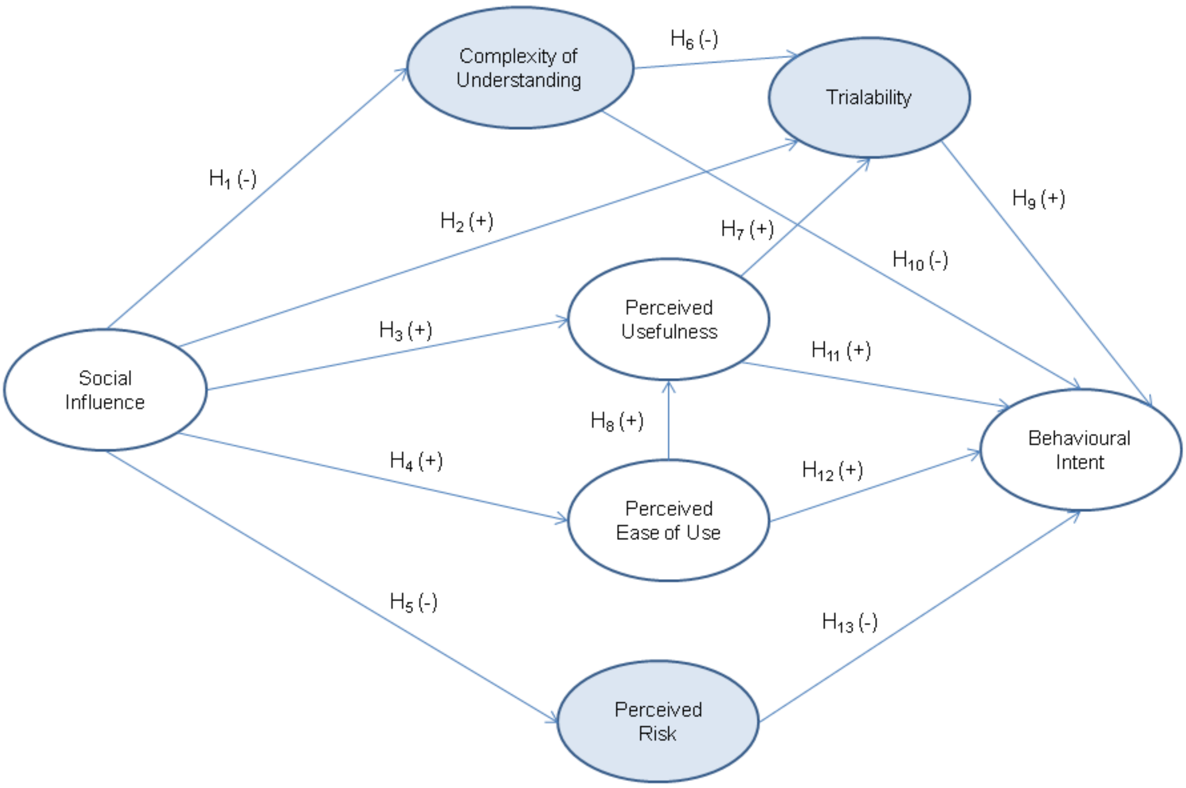

Figure 5: The Proposed Model for Investigation

The next chapter gives details of the research methodology used, the definition of the unit of analysis, the population, the sampling method and sample size, the research instrument, data collection and data analysis steps. The final section details the research limitations.

Chapter 4 : Research Methodology

4.1 Introduction

This chapter will detail the research methodology that was used to test the hypotheses and each of the relational links in the proposed model stated in Chapter 3. This research deals with concepts that are well established and have been previously studied by various researchers. However, trialability, perceived risk, complexity of understanding and social influence have not been previously linked in South Africa – a developing country – to provide a more complete model of cloud computing services adoption.

4.2 Research Method

The aim of this research was to understand the determinants of cloud computing adoption in an empirical research approach. The technique chosen to depict and test these relationships is the Partial Least Squares (PLS) method. This method is supported by Kline (2010) who states that the goal of PLS is to estimate predictive relations among latent variables.

PLS is superior to normal regression models. This is confirmed by Bagozzi and Fornell (1982) who declared that PLS is a second generation data analysis technique that can be used to examine the extent to which information systems (IS) research meets recognised standards for high quality analysis of statistics. The PLS method is thus in harmony with understanding the determinants of cloud computing services adoption.

The PLS method has a number of distinct advantages that made this technique particularly appropriate to this research. Firstly, PLS is designed to explain variance and as a consequence it is well suited to predictive applications and theory building (Gefen, Straub, & Boudreau, 2000). Secondly, according to Hair, Black, Babin and Anderson (2010) PLS is a robust technique that will provide a solution even when problems like poor measurement may prevent a result in other Structural Equation Modelling (SEM) techniques. Thirdly, PLS is particularly useful in generating estimates even with small samples as low as 30 observations or less (Gefen et al. 2000; Hair et al. 2010; Kline, 2010). Fourthly, according to Wu (2011), PLS is suitable for real world situations mainly because it does not make any assumptions about homogeneity in the sample population. Finally, Lauria and Duchessi (2007) state another advantage of PLS is that it maximises the variations between various constructs.

Because a requirement of the PLS method is that the research is quantitative in nature, a survey was compiled with basic organisational demographics and descriptive fields with Likert-type scale answers. The survey questionnaire was built from theory and stemmed from the constructs contained in the proposed model (Figure 5).

4.3 Unit of Analysis

According to Zikmund (2003) the unit of analysis is defined as a single element or a group of elements subject to selection in the sample. The unit of analysis for this study was defined as organisational decision-makers.

4.4 Population

Zikmund (2003) stated that a population is any complete group of people, companies, hospitals, stores, college students or the like that share some set of characteristics. For the purposes of this study, the population was all large South African organisations, excluding government. It was important for the study to have organisations that react to market forces of cloud computing adoption, and not government institutions that serve its citizenry with public goods and services.

4.5 Sampling and Size of Sample

Zikmund (2003) defined a sample as the representative subset of a population. Time and financial constraints prevented the collection of data from the entire population – or sampling frame (Saunders & Lewis, 2012). Due to the difficulty in obtaining data from the whole population it was decided to use a non-probability sampling technique called purposive sampling which relies on the researchers' judgement to select sample members (Saunders & Lewis, 2012).

The purposive sample used was sourced from Brainstorm magazine published by ITWeb called the "CIO Directory 2011 – Your guide to South Africa's IT decision-makers" (Hinchcliffe, 2011). The directory listing featured 150 senior IT decision-makers, most of who were CIO's, CTO's, CEO's, IT directors or IT managers of large South African organisations, including public enterprises. This directory of well-connected and influential respondents was a rich source of information for the questionnaire survey.

Another reason for using the purposive sampling method for this research is that the CIO Directory 2011 (Hinchcliffe, 2011) sample has diverse industry categories which allowed a wide variation to be collected in the data. The lists of industries in the sample are:

- Financial services
- Health and pharmaceuticals
- Industrial
- Information technologies
- Media
- Mining and resources
- Professional and business services
- Property and real estate
- Public sector (Government)
- Retail
- Telecommunication
- Travel and leisure

Additionally, this heterogeneous data allowed patterns and themes to emerge that may be of particular interest and value (Saunders & Lewis, 2012).

Of the original list of 150 IT decision-makers, 23 Public Sector members were removed from the sample. Only private organisations were considered for this study. This left 127 remaining members in the sample. After further analysis it was established that there were 28 members in the sample who worked for the same organisations. An exercise was undertaken to remove the 14 duplicated members, based on a rule that the lower ranking positions were removed from the sample. This left 113 members in the sample.

An additional exercise was undertaken to get the email addresses of the 113 members in the sample. The emails were sourced using techniques including telephoning the organisations and requesting the details, asking MBA cohorts working in the same organisations as sample members to obtain emails from the company listing and using

LinkedIn to find member contact details. Of the 113 members in the sample, two emails could not be found.

The sample dropped from 111 members to 107 members because four members had previously opted out from all SurveyMonkey surveys. The final sample used was 107 in size. Refer to Appendix A: Sample for a complete list of the 107 IT decision-makers.

4.6 Research Instrument

The research instrument used for this research was a questionnaire survey. According to Saunders and Lewis a questionnaire is a good technique for collecting data from respondents asking the same questions (2012, p. 141). Questionnaires are deemed to be valuable only when they fulfil the following criteria:

1) Collect data that are needed to answer the research questions (Saunders & Lewis, 2012);

   This criterion was met by using theory in the literature review to create the constructs and related questions in Chapter 2.

2) Collects data from a large enough number of respondents to answer the research question (Saunders & Lewis, 2012)

   This criterion was met by obtaining more survey respondents than the required minimum number of 30.

3) The questions provided are understood and correctly interpreted by the respondents in alignment with how the researcher wants them to be understood (Saunders & Lewis, 2012).

   This criterion was met by conducting two batches of pre-tests, prior to distributing the final survey.

The survey questionnaire was made up of two distinct sections. The first section had a demographic section which included: organisational level of respondents' position, type of organisation and size of organisation. The respondents were also asked if they intend to adopt, or have adopted cloud computing services in their organisations.

The second section of the questionnaire contained questions using the Likert scale (five-point). These questions were based on the constructs and the relationships between the constructs. The questions were rooted in theory and were crafted to make the respondents answer all the research questions.

The following constructs were posited in the questionnaire shown in Table 3:

- Social influence
- Perceived ease of use
- Perceived usefulness
- Behavioural intent
- Perceived risk
- Complexity of understanding
- Trialability

Table 3: Survey Questionnaire Related to Variables

Code	Construct	Measuring Item	Hypotheses	Source - Citations
Soc Infl1	Social Influence	People around me think it is a good idea for me to use cloud computing services.	H_1, H_2, H_3, H_4, H_5	(Campbell, 2007)
Soc Infl2		People around me have encouraged me to use cloud computing services.		
Soc Infl3		The media encourages me to use cloud computing services.		
Soc Infl4		Experts encourage me to use cloud computing services.		
PEofU1	Perceived Ease of Use	I think learning to use cloud computing services is easy.	H_8, H_{12}	(Edwin Cheng, Lam, & Yeung, 2006)
PEofU2		I think finding what I want via cloud computing services is easy.		
PEofU3		I think becoming skilful at using cloud computing services is easy.		
PEofU4		I think using cloud computing services is easy.		
PUse1	Perceived Usefulness	I think that using the cloud computing services would enable me to accomplish my organisations tasks more quickly.	$H_{7,}$ H_{11}	
PUse2		I think that using the cloud computing services would make it easier for my organisations to carry out its tasks.		
PUse3		I think that cloud computing services are useful.		
PUse4		Overall, I think that using cloud computing services is advantageous.		

Code	Construct	Measuring Item	Hypotheses	Source - Citations
Beh1	Behavioural Intent	I will definitely keep using cloud computing services.	H_9, H_{10}, H_{11}, H_{12}, H_{13}	(Venkatesh et al., 2003)
Beh2		I expect to be using cloud computing services in the future as well.		
Beh3		I think other organisations should use cloud computing services as well.		
PR1	Perceived Risk	Cloud computing services may not perform well because of unpredictable electricity supplies.	H_{13}	(Lee M. , 2009)
PR2		Cloud computing services may not perform well because of lack of adequate bandwidth.		
PR3		Cloud computing services may not perform well because of lack of connectivity.		
PR4		I worry that data transfer costs will be high.		
PR5		I worry that the financial risk of using cloud computing services will be too high.		
PR6		The potential to lose control of data and the related privacy issues may lead to a loss of status.		
PR7		I would not feel secure about the ability to retrieve data backups.		
PR8		I would not feel secure sending sensitive information using cloud computing services.		(Featherman & Pavlou, 2003)

Code	Construct	Measuring Item	Hypotheses	Source - Citations
CUnd1	Complexity of Understanding	The confusion around "what is cloud computing services" has delayed my intent to use cloud computing services.	H_6	Exploratory
CUnd2		It takes too long to learn how to use the cloud computing services to make it worth the effort.		(Thompson, Higgins, & Howell, 1991)
CUnd3		Using the cloud computing services involves too much time doing mechanical operations (for example: data input).		
CUnd4		Working with cloud computing services is so complicated; it is difficult to understand what is going on.		
Tr1	Trialability	I have had a great deal of opportunity to try various cloud computing services.	H_9	(Moore & Benbasat, 1991)
Tr2		I know where I can go to satisfactorily try out various uses of cloud computing services.		
Tr3		Before deciding whether to use any cloud computing services, I was able to properly try them out (try-before-you-buy).		
Tr4		The pay-per-use elasticity of cloud computing services allows for easier trialability of different cloud computing services.		

Refer to for a copy of the questionnaire with Likert scale questions.

4.7 Data Collection

4.7.1 Pre - Test

Zikmund (2003) recommends that a pilot study, or pre-test, is conducted on the questionnaire in order to establish if the respondents have any difficulty understanding the questions and also to confirm if there are any biased or ambiguous questions. In order to obtain feedback on the validity and correct interpretation of questions within the survey, a pre-test was conducted.

A pre-test was conducted using two batches. The first batch was directed at three pre-selected IT decision-makers – who were not part of the original sample. These IT decision-makers were based on a convenience sample and were requested to critique the design of the questionnaire including length, complexity, spelling errors and clarity of questions. The pre-test revealed several questions that were phrased ambiguously.

The changes recommended in the first pre-test were implemented into the survey and a second batch was sent to a statistician to clarify if the questions were biased, ambiguous and if the questions were aligned to the PLS method of data collection. The results of this pre-test afforded the researcher the opportunity to reverse the scales on all the questions and to adjust several questions containing negative slanted questions, in order to make the questions clear and easier to interpret.

The questionnaire was distributed electronically to the sample of 107 members after completing the two batches of pre-test and the corrections from both had been applied. The timeframe for this research was cross-sectional.

4.7.2 Survey Distribution

The final electronic survey questionnaire was prepared and distributed using SurveyMonkey™ to the intended sample population of 107 IT decision-makers via an email, including a hyperlink to the questionnaire. This research made use of the five-point Likert scale to allow respondents to indicate how strongly they agree or disagree with constructed statements. The scales offered were: strongly disagree, disagree, uncertain, agree and strongly agree (Zikmund, 2003).

An initial follow up email took place one week after the initial survey distribution. This reminded potential respondents that their participation and completion of the survey is important for research purposes. A subsequent final reminder was sent one week after the follow up mail. The survey was closed three weeks after the first distribution.

4.8 Data Analysis

This part of the research performed data analysis using SmartPLS software. SmartPLS is a software application for path modelling with latent variables. Once the data was collected – after the survey was closed – four steps were completed for the analysis to be considered complete:

Step 1: Evaluate the *a priori* model and modify the measurement items to create the *a posteriori* model

The initial model is called *a priori* because it means "from what comes before". The later model is called *a posteriori* because it means "from what comes later".

Step 2: Assess the *a posteriori* measurement model

Step 3: Test the hypotheses of the *a posteriori* model structure

Step 4: Present the *a posteriori* structural model

These four steps are explained in the following sections.

4.8.1 Evaluate and Modify the Measurement Items

In the first step the *a priori* model is evaluated and modified by removing poor measurement items from the item loadings. This results in the *a posteriori* model. Loadings, or factor loadings, are defined by Gefen et al. (2000) as weightings which reflect the correlation between the original variables and the derived factors. The commonly cited .40 minimum loading level Hair et al. (2010) gives a benchmark to compare against. Narandas (2009) proposes that the loadings on the paths between the constructs and variables should be >.55. This research used a level of .45 in order to remove poor indicators.

After removing these poor indicators the structural model was modified to form the *a posteriori* model. This *a posteriori* model was used to assess the measurement model and test the hypotheses. The *a posteriori* model will be presented, in the final fourth step, after the assessments and tests have been conducted.

4.8.2 Assess the Measurement Model

The second step involved the measurement model specifying the indicators for each construct and assessing the reliability of each construct for estimating the predictive relations among the latent variables. The seven constructs assessed were: social influence, trialability, complexity of understanding, perceived risk, perceived usefulness, perceived ease of use and behavioural intent.

Social influence is an exogenous construct that acts only as a predictor for other constructs in the model. Gefen et al. (2000) states that exogenous constructs only have predictor arrows leading out of them and are not predicted by any other constructs in the model. The remaining six constructs are endogenous constructs. Zikmund (2003) provides an explanation of a dependent or endogenous variable as a variable that is to be predicted or explained. Gefen et al. (2000) propose that reflective variables are observed variables that reflect the latent variable and as a representation of the latent variable should be correlated and one-dimensional.

The reliability of the main constructs is evaluated for internal consistency using Cronbach's alpha. Cronbach's alpha is a measure of reliability that is commonly used for a set of two or more construct indicators. A Cronbach's alpha value above 0.60 is considered acceptable for each construct in this research (Wu & Wang, 2005). In addition to Cronbach's alpha measure, a composite reliability (CR) and average variance extracted (AVE) value was measured per construct.

Composite reliability measures the reliability of the constructs, while Gefen et al. (2000) define AVE as measuring the percentage of variance captured by a construct and showing the ratio of the sum of the variance captured by the construct and measurement variance. According to Fornell and Larcker (1981) a CR value higher than 0.7 and an AVE value higher than 0.5 is acceptable.

Gefen et al. (2000) propose that R^2 is the coefficient of determination that is the measure of the proportion of the variance of the dependent variable about its mean that is explained by the independent variable or variables. Based on Cohen (1992) the criterion for small, medium and large effect sizes for multiple correlations a R^2 value of .5 or higher would indicate an effect size considered to be medium or large.

There are no overall fit statistics in PLS, however Gefen et al. (2000) state that PLS can estimate t-values of the loadings using the bootstrap technique. Bootstrapping allows a viable alternative when sample sizes are small because conclusions about the characteristics of a population are made from the given sample. In summary, Cronbach's alpha, CR, AVE, R^2 and t-values of the loadings via bootstrapping will be used to assess the measurement model.

4.8.3 Test the Hypotheses

Step three tested the hypotheses of the structural model using bootstrapped t-values of path coefficients and testing for significant path coefficients. Although PLS does not supply the probability values (p-values) associated with each t-test of the parameter estimates and factor loadings, t-values of 2.0 or more are considered significant. Thus this convention was adopted in reporting the significance of parameter estimates throughout this research is based on this criterion.

Gefen et al. (2000) states that the statistical objective of PLS is to show high R^2 and significant t-values, thus rejecting the null hypothesis of null effect. The path coefficient in the analysis shows the value of the contribution of a given variable on another variable, given that all the other variables also have an effect.

4.8.4 Present the Structural Model

The *a posteriori* model will be presented after the data analysis steps of evaluation, modification, assessment and testing has been completed. Gefen et al. (2000) confirms that the structural model is a set of dependant relationships that link the model constructs.

4.8.5 Data Analysis Summary

Hair et al. (2010) states that PLS specifies relationships in terms of measurement (outer) and structural (inner) models. The approach taken in this research has been defined in the data analysis steps.

In Table 4 a summary of the PLS statistics used for data analysis are tabulated while highlighting how the measurement and structural models relate to the data analysis approach taken in this research.

Table 4: PLS Data Analysis Summary

Step	Step Description	Model Type	PLS Statistics	Measurement / Structural / Other
1	Evaluate the *a priori* model and modify the measurement items to create the *a posteriori* model	*A priori* and *a posteriori*	Item loadings	Measurement (outer)
2	Assess the *a posteriori* measurement model	*A posteriori*	Cronbach's alpha	Constructs
			Average Variance Extracted	Structural (inner)
			Composite Reliability	Constructs
			R^2	Structural (inner)
			Bootstrap t-values of the loadings	Measurement (outer)
3	Test the hypotheses of the *a posteriori* model structure	*A posteriori*	Bootstrap t-values of path coefficients	Structural (inner)
			Path coefficients	Structural (inner)
4	Present the *a posteriori* structural model	*A posteriori*	None	Overall model

4.9 Research Limitations

The research limitations included:

- Cloud computing is a diverse topic and the number of constructs that can be used to establish relationships are too vast for this study therefore there will be other models that can enhance, or be used in conjunction with this model.
- Gefen et al. (2000) states that the sample size should be at least ten times the number of items in the most composite construct. The perceived risk construct initially used eight items indicating a sample of 80. The sample could be increased or the items in large constructs should be reduced.
- Kline (2010) acknowledges a drawback of PLS is that its bias and consistency estimates are statistically inferior compared to those generated by a full-information estimation like SEM.

4.10 Summary

This chapter detailed the research methodology and approach adopted for this research study. The literature review favoured a quantitative method as this was a causal study. The PLS technique was determined as the preferred method of research due to its robustness, usefulness in generating estimates with small samples and its applicability to predictive applications and theory building. The purposive sample used was sourced from a magazine listing 150 senior IT decision-makers. The data collected for the study used a survey method with a Likert scale. The following chapter presents the results of the data collected.

Chapter 5 : Research Results

5.1 Introduction

The objective of this section is to present the sample, results and statistical analysis findings. The data analysis takes place in four steps after the sample results and descriptive statistics have been presented.

Firstly, the measurement items are evaluated and modified. Secondly, the measurement model is assessed at a construct level. The seven constructs of social influence, complexity of understanding, perceived ease of use, perceived usefulness, trialability, perceived risk and behavioural intent are all assessed. Thirdly, each of the 13 hypotheses of the model structure is tested. Finally, the structural model is presented.

5.2 Sample Results and Descriptive Statistics

The purposive sample used was sourced from Brainstorm magazine published by ITWeb called the "CIO Directory 2011 – Your guide to South Africa's IT decision-makers" (Hinchcliffe, 2011). The directory listing featured 150 senior IT decision-makers, most of who were CIO's, CTO's, CEO's, IT directors or IT managers of large South African organisations, including public enterprises.

Of the original list of 150 IT decision-makers 23 Public Sector members were removed from the sample. This left 127 remaining members in the sample. An exercise was undertaken to remove 14 duplicated members. This left 113 members in the sample. Of the 113 members in the sample, two emails could not be found. The sample dropped from 111 members to 107 members because four members had previously opted out from all SurveyMonkey surveys. The final sample used was 107 (Appendix A: Sample).

5.2.1 Response Rate

There were a total of 107 survey questionnaires distributed. A total of 39 responses were received. All of the responses were valid and complete. Therefore none of the responses were rejected due to incomplete information. This is a response rate of 36%.

5.2.2 Demographic Characteristics

This section outlines the demographic characteristics of the respondents which include the position of the respondent, type of organisation, size of the organisation and the age of the organisation.

5.2.2.1 Respondent Status or Position

The majority of respondents (Table 5) comprised senior IT decision-makers. The largest group of respondents were CIO's (69.2%). The second largest group consisted of IT Managers (15.4%). The third and fourth largest respondents included CEO's and CTO's at 5.1% each.

The combination of C-suite and director respondents equalled 81.8% - representing an overwhelming percentage of the responses. This cohort is the most powerful influencers and decision-makers in the organisation as they are engaged in boardroom decisions and the strategy of the organisation. This cohort is compact with excellent exemplars for IT decision-makers in large South African organisations.

Table 5: Position

Position in Organisation	**Percentage (%)**	**Frequency**
CIO	69.2%	27
IT Manager	15.4%	6
CEO	5.1%	2
CTO	5.1%	2
Director	2.6%	1
IT Decision-Maker	2.6%	1
Total	**100%**	**39**

5.2.2.2 Organisation Type

The organisation type or industry of the respondents was based on 11 categories (Table 6). The largest group of respondents came from organisations that were classified as "Other" (17.9%). The second largest group (15.4%) of respondents were from the financial services industry. Sharing the second largest position was the information technology industry, closely followed by professional and business services at 13%.

Table 6: Organisation Type

Organisation Type	Percentage (%)	Frequency
Other	17.9%	7
Financial Services	15.4%	6
Information Technology	15.4%	6
Professional and Business Services	12.8%	5
Industrial	10.3%	4
Health and Pharmaceuticals	5.1%	2
Mining and Resources	5.1%	2
Retail	5.1%	2
Telecommunication	5.1%	2
Travel and Leisure	5.1%	2
Property and Real Estate	2.6%	1
Total	**100%**	**39**

5.2.2.3 Organisation Size

The respondents' with the largest organisation size work in organisations (28.2%) between 1000-4999 employees (Table 7). The second largest group at 20.5% work for organisations with 10 000 or more employees.

Table 7: Organisation Size

Organisation Size	Percentage (%)	Frequency
10 000 or more	20.5%	8
5000 - 9 999	10.3%	4
1000 - 4 999	28.2%	11
500 - 999	15.4%	6
100 - 499	10.3%	4
50 - 99	7.7%	3
1 - 49	7.7%	3
Total	**100%**	**39**

5.2.2.4 Organisation Age

A large majority of respondents (89.7%) work in organisations that are over five years of age (Table 8). The second largest group (7.7%) worked in organisations between three and five years of age.

Table 8: Organisation Age

Organisation Age	Percentage (%)	Frequency
> 5 years	89.7%	35
Between 3 and 5 years	7.7%	3
Between 1 and 3 years	0.0%	0
< 1 year	2.6%	1
Total	**100%**	**39**

5.2.3 Descriptive Analysis Results

In order to determine whether respondents were currently using or intending to use cloud computing services the respondents were asked if there organisations used cloud computing services (Table 9). A ‘Yes’ and a ‘No’ category was provided. The largest group of 25 respondents already used cloud computing services (64.1%). The smaller group of 14 respondents answered ‘No’ (35.9%)

A related question was asked to all the respondents answering ‘No’ to the initial question about cloud computing services usage. The related question asked if the organisation intended to adopt cloud computing services within the next three years. The majority of respondents whose organisation were currently not using cloud computing services declared an intention to use the cloud computing services (71.4%).

Four respondents out of the 39 respondents' organisations did not use cloud computing services and were not intending to in the next three years.

Table 9: Usage and Intent of Cloud Computing Services

	Percentage (%)	Frequency
Organisation usage of cloud computing services		
Yes	64.1%	25
No	35.9%	14
Total	**100%**	**39**
Organisation intent to adopt cloud computing services within the next three years		
Yes	71.4%	10
No	28.6%	4
Total	**100%**	**14**

5.3 Evaluate and Modify the Measurement Items

This section tests the *a priori* structural model based on R^2, path coefficients and t-values. The item loadings are analysed for significance. Based on these results the *a priori* structural model will be modified into the *a posteriori* structural model (Figure 26).

As part of the evaluation and model testing the statistical significance of item loadings was determined. The following loadings were below the accepted level and subsequently identified as poor indicators:

- The first item in the complexity scale: "The confusion around 'what is cloud computing services' has delayed my intent to use cloud computing services".
- The first item on the perceived risk scale: "Cloud computing services may fail because of unpredictable electricity supplies".
- The third item on the perceived risk scale: "Cloud computing services may fail because of lack of connectivity". The fourth item on the perceived risk scale: "I worry that data transfer costs will be high."
- The third item on the social influence scale: "The media encourages me to use cloud computing services".

The item loadings that were not significant were removed from the *a priori* structural model in order to modify and enhance into the validity of the *a posteriori* structural model with scales composed only of items with significant loadings. The *a priori* structural model had 31 measuring items and with the removal of five poor indicators. Thus the new *a posteriori* model had 26 measuring items included.

5.4 Assess the Measurement Model

The measurement model assesses the loadings of the 26 measurement items on their expected constructs, or latent variables. The measurement model section analyses the item loadings which are fundamental to the measurement model. Moreover this section also includes structural model components like the bootstrapped t-values of individual item loadings, reliability and convergent validity**.**

This analysis format allows the study to focus on the construct level in the measurement model section.

5.4.1 Social Influence Measures

The measuring items provided in Table 10 reflect the actual items that were measured in the survey and form the social influence construct.

Table 10: Social Influence Construct Measuring Items

Indicator	Measuring Item
Soc infl1	People around me think it is a good idea for me to use cloud computing services
Soc infl2	People around me have encouraged me to use cloud computing services
Soc infl4	Experts encourage me to use cloud computing services

Table 11: Social Influence Reliability and Convergent Validity

Construct	AVE	Composite Reliability	Cronbach's Alpha
Social influence	0.762	0.905	0.842

The Cronbach's alpha measure (Table 11) at 0.842 is reliable. The AVE measure is 0.762 and the CR measure is 0.905. Therefore this construct has satisfactory reliability and convergent validity.

The item loadings and t-values for social influence are depicted on the left and right hand sides of the construct respectively in Figure 6. The items are abbreviated as described in Table 10.

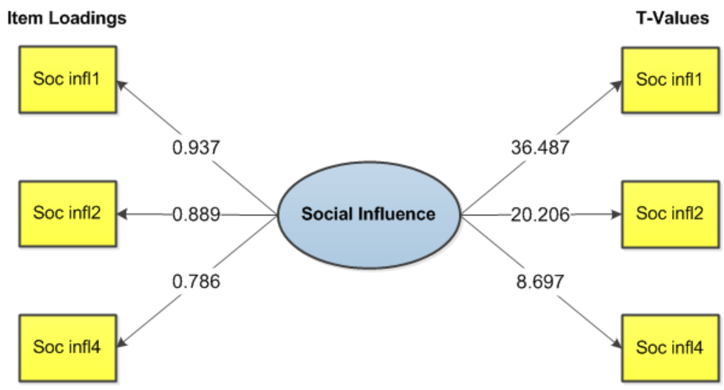

Figure 6: Item Loadings and T-Values for Social Influence

Soc infl1 has a significant positive factor loading of 0.937 on social influence (t=36.487, p<0.001).

Soc infl2 has a significant positive factor loading of 0.889 on social influence (t=20.206, p<0.001).

Soc infl4 has a significant positive factor loading of 0.786 on social influence (t=8.697, p<0.001).

5.4.2 Complexity of Understanding

The measuring items provided in Table 12 reflect the actual items that were measured in the survey and form the complexity of understanding construct.

Table 12: Complexity of Understanding Construct Measuring Items

Indicator	Measuring Item
CUnd2	It takes too long to learn how to use cloud computing services to make it worth the effort.
CUnd3	Using cloud computing services involves too much time doing mechanical operations (for example: data input).
CUnd4	Working with cloud computing services is so complicated; it is difficult to understand what is going on.

Table 13: Complexity of Understanding Reliability and Convergent Validity

Construct	AVE	Composite Reliability	Cronbach's Alpha
Complexity of Understanding	0.677	0.862	0.760

The Cronbach's alpha measure (Table 13) at 0.760 implies satisfactory internal consistency reliability. The AVE measure is 0.677 and the CR measure is 0.862. Therefore this construct has satisfactory reliability and convergent validity.

The item loadings and t-values for complexity of understanding are depicted on the left and right hand sides of the construct respectively in Figure 7. The items are abbreviated as described in Table 12.

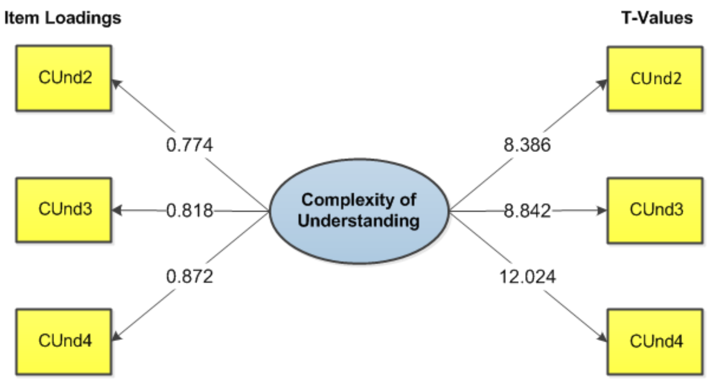

Figure 7: Item Loadings and T-Values Complexity of Understanding

CUnd2 has a significant positive factor loading of 0.774 on complexity of understanding ($t=8.386$, $p<0.001$).

CUnd3 has a significant positive factor loading of 0.818 on complexity of understanding ($t=8.842$, $p<0.001$).

CUnd4 has a significant positive factor loading of 0.872 on complexity of understanding ($t=12.024$, $p<0.001$).

5.4.3 Perceived Ease of Use

The measuring items provided in Table 14 reflect the actual items that were measured in the survey and form the perceived ease of use construct.

Table 14: Perceived Ease of Use Construct Measuring Items

Indicator	Measuring Item
PEofU1	Learning to use cloud computing services is easy
PEofU2	Finding what I want via cloud computing services is easy
PEofU3	Becoming skilful at using cloud computing services is easy
PEofU4	Using cloud computing services is easy

Table 15: Perceived Ease of Use Reliability and Convergent Validity

Construct	AVE	Composite Reliability	Cronbach's Alpha
Perceived Ease of Use	0.542	0.825	0.722

The Cronbach's alpha measure (Table 15) at 0.722 implies satisfactory internal consistency reliability. The AVE measure is 0.542 and the CR measure is 0.825. Therefore this construct reaches a satisfactory convergent reliability and validity.

The item loadings and t-values for perceived ease of use are depicted on the left and right hand sides of the construct respectively in Figure 8. The items are abbreviated as described in Table 14.

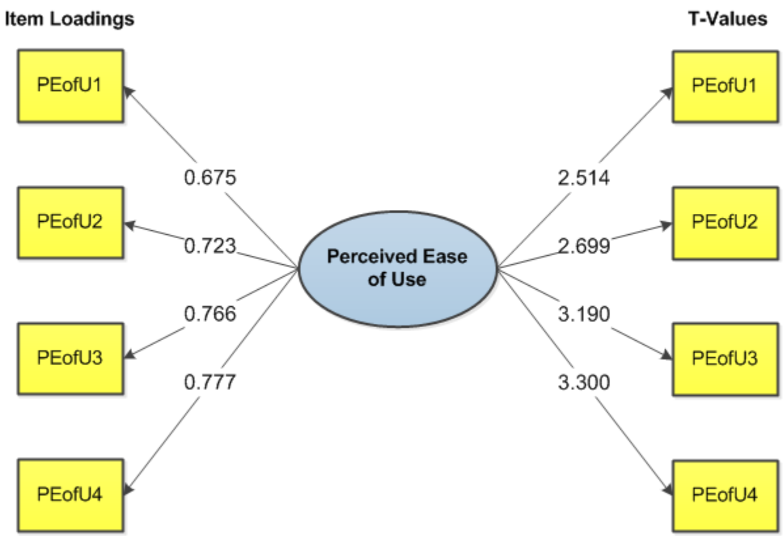

Figure 8: Item Loadings and T-Values for Perceived Ease of Use

PEofU1 has a significant positive factor loading of 0.675 on perceived ease of use ($t=2.514$, $p<0.001$).

PEofU2 has a significant positive factor loading of 0.723 on perceived ease of use ($t=2.699$, $p<0.001$).

PEofU3 has a significant positive factor loading of 0.766 on perceived ease of use ($t=3.190$, $p<0.001$).

PEofU4 has a significant positive factor loading of 0.777 on perceived ease of use ($t=3.300$, $p<0.001$).

5.4.4 Perceived Usefulness

The measuring items provided in Table 16 reflect the actual items that were measured in the survey and form the perceived usefulness construct.

Table 16: Perceived Usefulness Construct Measuring Items

Indicator	Measuring Item
PUse1	Using cloud computing services would enable me to accomplish my organisations' tasks more quickly.
PUse2	Using cloud computing services would make it easier for my organisation to carry out its tasks.
PUse3	Cloud computing services are useful.
PUse4	Using cloud computing services are advantageous.

Table 17: Perceived Usefulness Reliability and Convergent Validity

Construct	AVE	Composite Reliability	Cronbach's Alpha
Perceived Usefulness	0.681	0.895	0.843

The Cronbach's alpha measure (Table 17) at 0.843 implies good internal consistency reliability. The AVE measure is 0.681 and the CR measure is 0.895. Therefore this construct reaches a satisfactory reliability and convergent validity.

The item loadings and t-values for perceived usefulness are depicted on the left and right hand sides of the construct respectively in Figure 9. The items are abbreviated as described in Table 16.

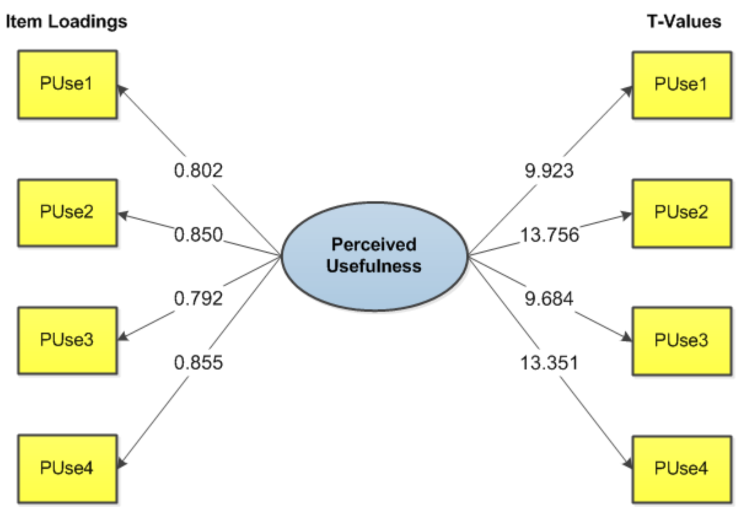

Figure 9: Item Loadings and T-Values for Perceived Usefulness

PUse1 has a significant positive factor loading of 0.802 on perceived usefulness (t=9.923, p<0.001).

PUse2 has a significant positive factor loading of 0.850 on perceived usefulness (t=13.756, p<0.001).

PUse3 has a significant positive factor loading of 0.792 on perceived usefulness (t=9.684, p<0.001).

PUse4 has a significant positive factor loading of 0.855 on perceived usefulness (t=13.351, p<0.001).

5.4.5 Trialability

The measuring items provided in Table 18 reflect the actual items that were measured in the survey and form the trialability construct.

Table 18: Trialability Construct Measuring Items

Indicator	Measuring Item
Tr1	I have had a great deal of opportunity to try various cloud computing services.
Tr2	I know where I can go to satisfactorily try out various uses of cloud computing services.
Tr3	Before deciding whether to use any cloud computing services, I was able to properly try them out (try-before-you-buy).
Tr4	The pay-per-use elasticity of cloud computing services allows for easier trialability of different cloud computing.

Table 19: Trialability Reliability and Convergent Validity

Construct	AVE	Composite Reliability	Cronbach's Alpha
Trialabilty	0.674	0.892	0.839

The Cronbach's alpha measure (Table 19) at 0.839 implies satisfactory internal consistency reliability. The AVE measure is 0.674 and the CR measure is 0.892. Therefore this construct reaches a satisfactory reliability and convergent validity.

The item loadings and t-values for Trialability are depicted on the left and right hand sides of the construct respectively in Figure 10. The items are abbreviated as described in Table 18.

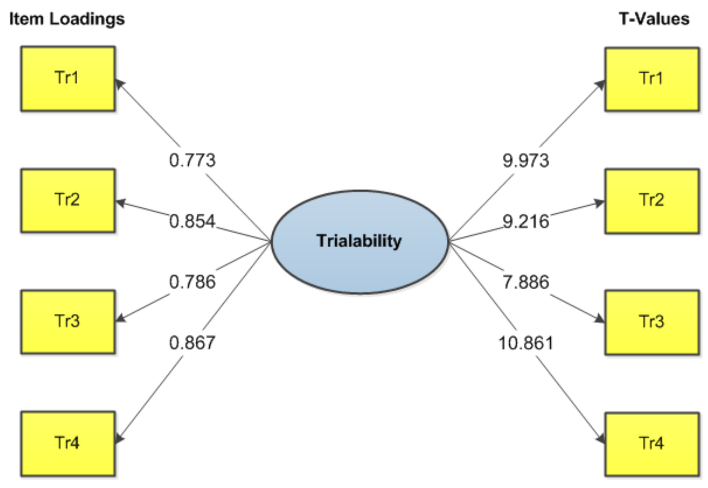

Figure 10: Item Loadings and T-Values for Trialability

Tr1 has a significant positive factor loading of 0.773 on trialability ($t=9.973$, $p<0.001$).

Tr2 has a significant positive factor loading of 0.854 on trialability ($t=9.216$, $p<0.001$).

Tr3 has a significant positive factor loading of 0.786 on trialability ($t=7.886$, $p<0.001$).

Tr4 has a significant positive factor loading of 0.867 on trialability ($t=10.861$, $p<0.001$).

5.4.6 Perceived Risk

The measuring items provided in Table 20 reflect the actual items that were measured in the survey and form the perceived risk construct.

Table 20: Perceived Risk Construct Measuring Items

Indicator	Measuring Item
PR2	Cloud computing services may fail because of lack of adequate bandwidth.
PR5	I worry that the financial risk of using cloud computing services will be too high.
PR6	The potential to lose control of data and the related privacy issues may lead to a loss of status.
PR7	I would feel insecure about the ability to retrieve data backups.
PR8	I would feel insecure sending sensitive information using cloud computing services.

Table 21: Perceived Risk Reliability and Convergent Validity

Construct	AVE	Composite Reliability	Cronbach's Alpha
Perceived Risk	0.458	0.803	0.707

The Cronbach's alpha measure (Table 21) at 0.707 implies satisfactory internal consistency reliability. The AVE measure is 0.458 and the CR measure is 0.803. Therefore this construct reaches a satisfactory reliability. The AVE is nominally below the accepted 0.5 criteria for convergent validity.

The item loadings and t-values for perceived risk are depicted on the left and right hand sides of the construct respectively in Figure 11. The items are abbreviated as described in Table 20.

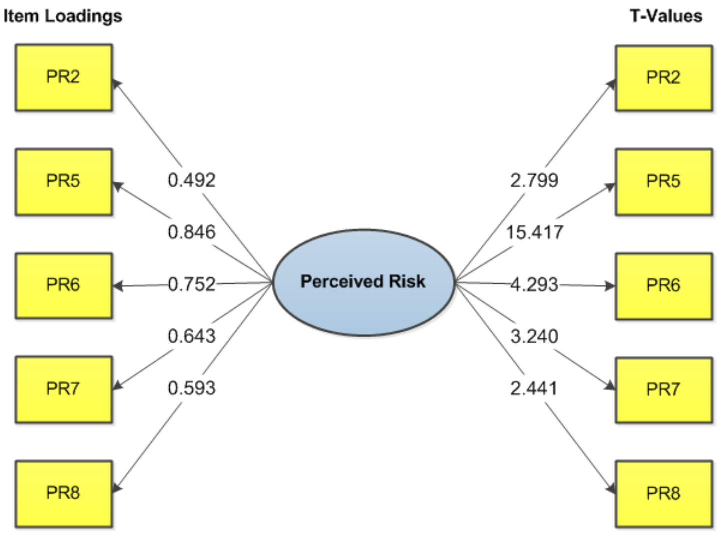

Figure 11: Item Loadings and T-Values for Perceived Risk

PR2 has a significant positive factor loading of 0.492 on perceived risk (t=2.799, p<0.001).

PR5 has a significant positive factor loading of 0.846 on perceived risk (t=15.417, p<0.001).

PR6 has a significant positive factor loading of 0.752 on perceived risk (t=4.293, p<0.001).

PR7 has a significant positive factor loading of 0.643 on perceived risk (t=3.240, p<0.001).

PR8 has a significant positive factor loading of 0.593 on perceived risk (t=2.441, p<0.001).

5.4.7 Behavioural Intent

The measuring items provided in Table 22 reflect the actual items that were measured in the survey and form the behavioural intent construct.

Table 22: Behavioural Intent Construct Measuring Items

Indicator	Measuring Item
BehI1	I will definitely keep using cloud computing services.
BehI2	I expect to be using cloud computing services in the future as well.
BehI3	Other organisations should use cloud computing services as well.

Table 23: Behavioural Intent Reliability and Convergent Validity

Construct	AVE	Composite Reliability	Cronbach's Alpha
Behavioural intent	0.763	0.905	0.842

The Cronbach's alpha measure (Table 23) at 0.842 implies high internal consistency reliability. The AVE measure is 0.763 and the CR measure is 0.905. Therefore this construct reaches a satisfactory reliability and convergent validity.

The item loadings and t-values for behavioural intent are depicted on the left and right hand sides of the construct respectively in Figure 12. The items are abbreviated as described in Table 22.

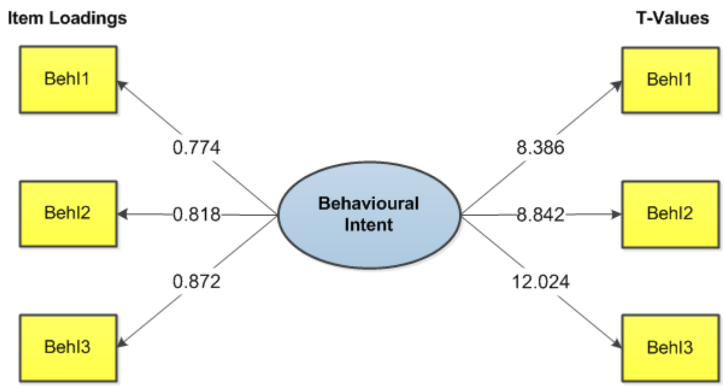

Figure 12: Item Loadings and T-Values for Behavioural Intent

BehI1 has a significant positive factor loading of 0.912 on behavioural intent (t=8.386, p<0.001).

BehI2 has a significant positive factor loading of 0.937 on behavioural intent (t=8.842, p<0.001).

BehI3 has a significant positive factor loading of 0.760 on behavioural intent (t=12.024, p<0.001).

All of the 26 measurement items loadings, forming part of the measurement model, on their expected constructs have significant positive factor loadings. Similarly all of the structural model components (bootstrapped t-values of individual item loadings, reliability and convergent validity) are supported, excluding the AVE of Perceived Risk.

5.5 Test the Hypotheses of the Model Structure

The structural model describes the assumed causation among a set of dependent and independent, or latent constructs. In this study there are seven latent constructs. Social Influence is an exogenous construct. The remaining six constructs are endogenous: complexity of understanding, perceived ease of use, perceived usefulness, perceived risk, trialability and behavioural intent.

This model supports the reflective relationship style. Reflective variables are drawn with the arrow pointing away from the latent construct.

5.5.1 Test Hypothesis 1

H_1: Social influence has a direct negative effect on complexity of understanding

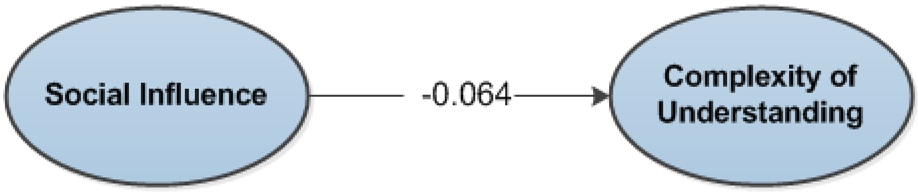

Figure 13: Path Coefficient Hypothesis 1

The path coefficient between social influence and complexity of understanding shown in Figure 13 is negative, but not significant at -0.064 (t=.286, p>0.05). Therefore the structural equation model does not provide support for hypothesis H_1.

5.5.2 Test Hypothesis 2

H_2: Social influence has a direct positive effect on trialability

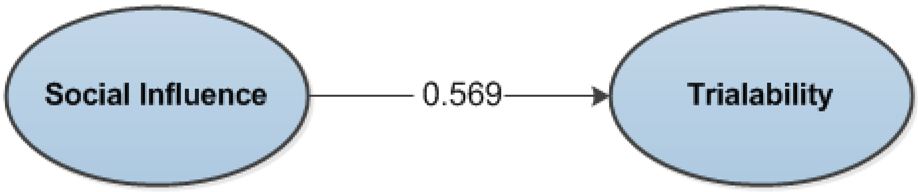

Figure 14: Path Coefficient Hypothesis 2

The path coefficient between social Influence and trialability shown in Figure 14 is significant and positive at 0.569 (t=2.218, p<0.05). Therefore the structural equation model does provide sufficient support for hypothesis H_2.

5.5.3 Test Hypothesis 3

H_3: Social influence has a direct positive effect on perceived usefulness

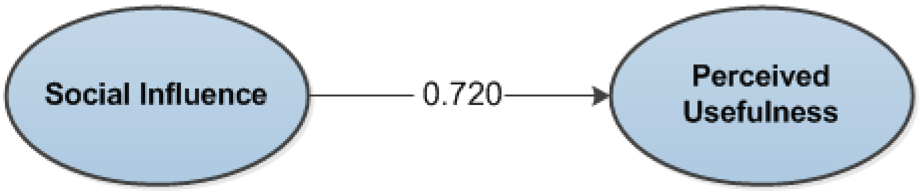

Figure 15: Path Coefficient Hypothesis 3

The path coefficient between social influence and perceived usefulness shown in Figure 16 is significant and positive at 0.720 (t=7.236, $p<0.05$). Therefore the structural equation model does provide sufficient support for hypothesis H_3.

5.5.4 Test Hypothesis 4

H_4: Social influence has a direct positive effect on perceived ease of use

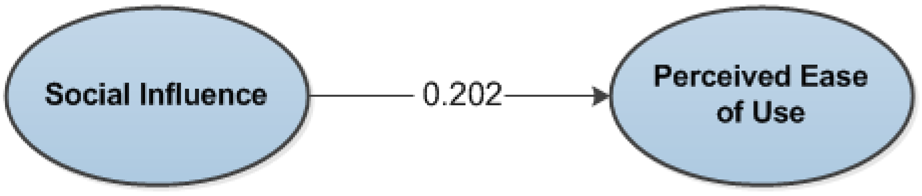

Figure 16: Path Coefficient Hypothesis 4

The path coefficient between social Influence and perceived ease of use shown in Figure 16 is positive, but not significant at 0.202 (t=1.321, $p>0.05$). Therefore the structural equation model does not provide support for hypothesis H_4.

5.5.5 Test Hypothesis 5

H_5: Social influence has a direct negative effect on perceived risk

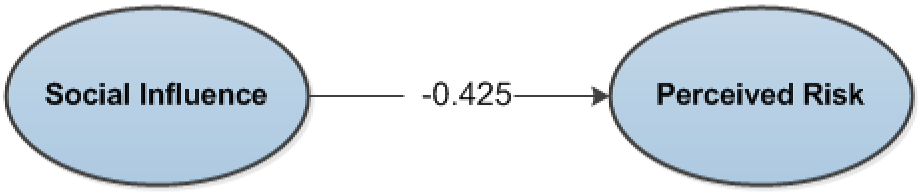

Figure 17: Path Coefficient Hypothesis 5

The path coefficient between social influence and perceived risk shown in Figure 17 is negative and significant at -0.425 (t=3.331, $p<0.05$). Therefore the structural equation model does provide support for hypothesis H_5.

5.5.6 Test Hypothesis 6

H_6: Complexity of understanding has a direct negative effect on trialability

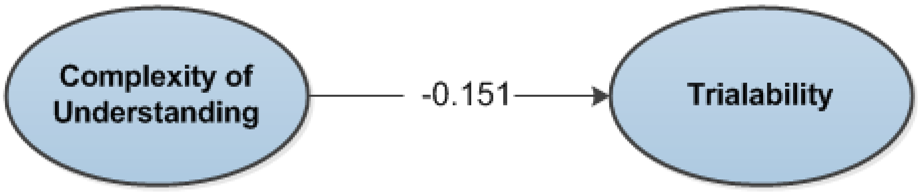

Figure 18: Path Coefficient Hypothesis 6

The path coefficient between complexity of understanding and trialability shown in Figure 18 is negative, but not significant at -0.151 (t=.938, $p>0.05$). Therefore the structural equation model does not provide support for hypothesis H_6.

5.5.7 Test Hypothesis 7

H_7: Perceived usefulness has a direct positive effect on trialability

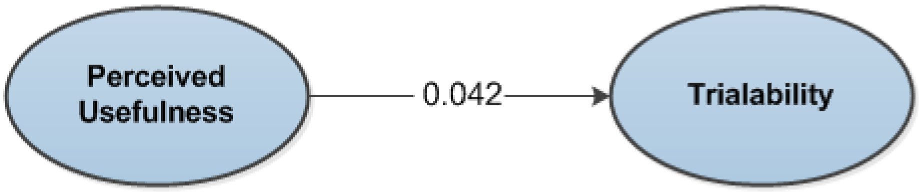

Figure 19: Path Coefficient Hypothesis 7

The path coefficient between perceived usefulness and trialability shown in Figure 19 is positive, but not significant at 0.042 (t=.205, p>0.05). Therefore the structural equation model does not provide support for hypothesis H_7.

5.5.8 Test Hypothesis 8

H_8: Perceived ease of use has a direct positive effect on perceived usefulness

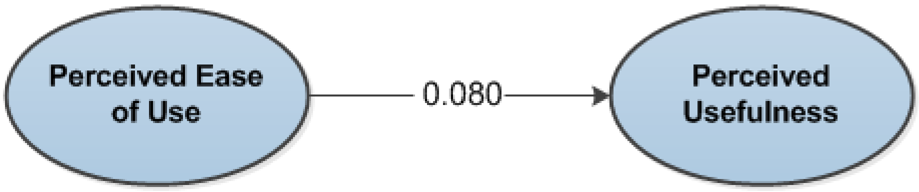

Figure 20: Path Coefficient Hypothesis 8

The path coefficient between perceived ease of use and perceived usefulness shown in Figure 20 is positive, but not significant at 0.080 (t=.664, p>0.05). Therefore the structural equation model does not provide support for hypothesis H_8.

5.5.9 Test Hypothesis 9

H_9: Trialability has a direct positive effect on behavioural intent

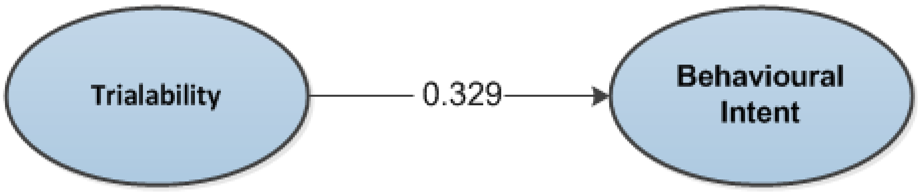

Figure 21: Path Coefficient Hypothesis 9

The path coefficient between trialability and behavioural intent shown in Figure 21 is significant and positive at 0.329 ($t=2.588$, $p<0.05$). Therefore the structural equation model does provide support for hypothesis H_9.

5.5.10 Test Hypothesis 10

H_{10}: Complexity of understanding has a direct negative effect on behavioural intent

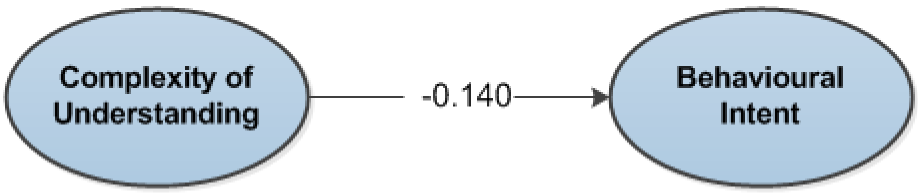

Figure 22: Path Coefficient Hypothesis 10

The path coefficient between complexity of understanding and behavioural intent show in Figure 22 is negative, but not significant at -0.140 ($t=1.098$, $p>0.05$). Therefore the structural equation model does not provide support for hypothesis H_{10}.

5.5.11 Test Hypothesis 11

H_{11}: Perceived usefulness has a direct positive effect on behavioural intent

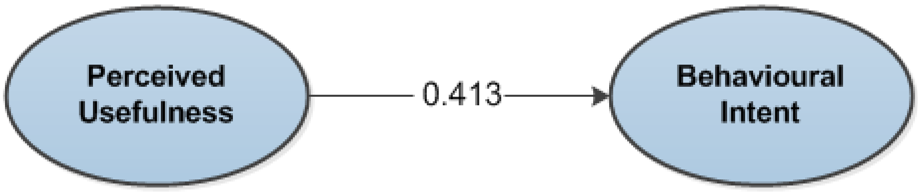

Figure 23: Path Coefficient Hypothesis 11

The path coefficient between perceived usefulness and behavioural intent shown in Figure 23 is significant and positive at 0.413 ($t=2.887$, $p<0.05$). Therefore the structural equation model does provide sufficient support for hypothesis H_{11}.

5.5.12 Test Hypothesis 12

H_{12}: Perceived ease of use has a direct positive effect on behavioural intent

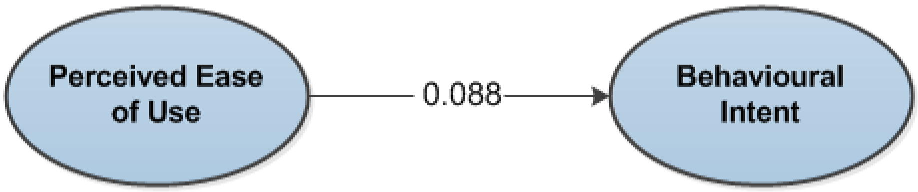

Figure 24: Path Coefficient Hypothesis 12

The path coefficient between perceived ease of use and behavioural intent shown in Figure 24 is positive, but not significant at 0.088 ($t=.712$, $p>0.05$). Therefore the structural equation model does not provide support for hypothesis H_{12}.

5.5.13 Test Hypothesis 13

H_{13}: Perceived risk has a direct negative effect on behavioural intent

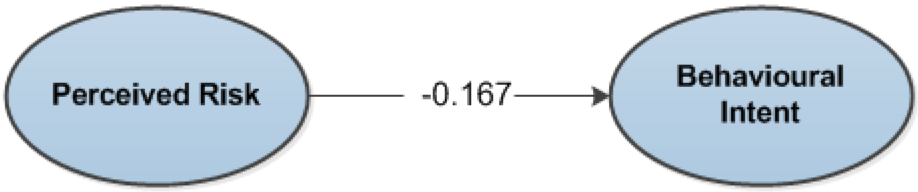

Figure 25: Path Coefficient Hypothesis 13

The path coefficient between perceived risk and behavioural intent shown in Figure 25 is negative, but not significant at -0.167 (t=1.319, p>0.05). Therefore the structural equation model does not provide support for hypothesis H_{13}.

5.6 Present the Structural Model

The *a posteriori* model is presented in Figure 26.

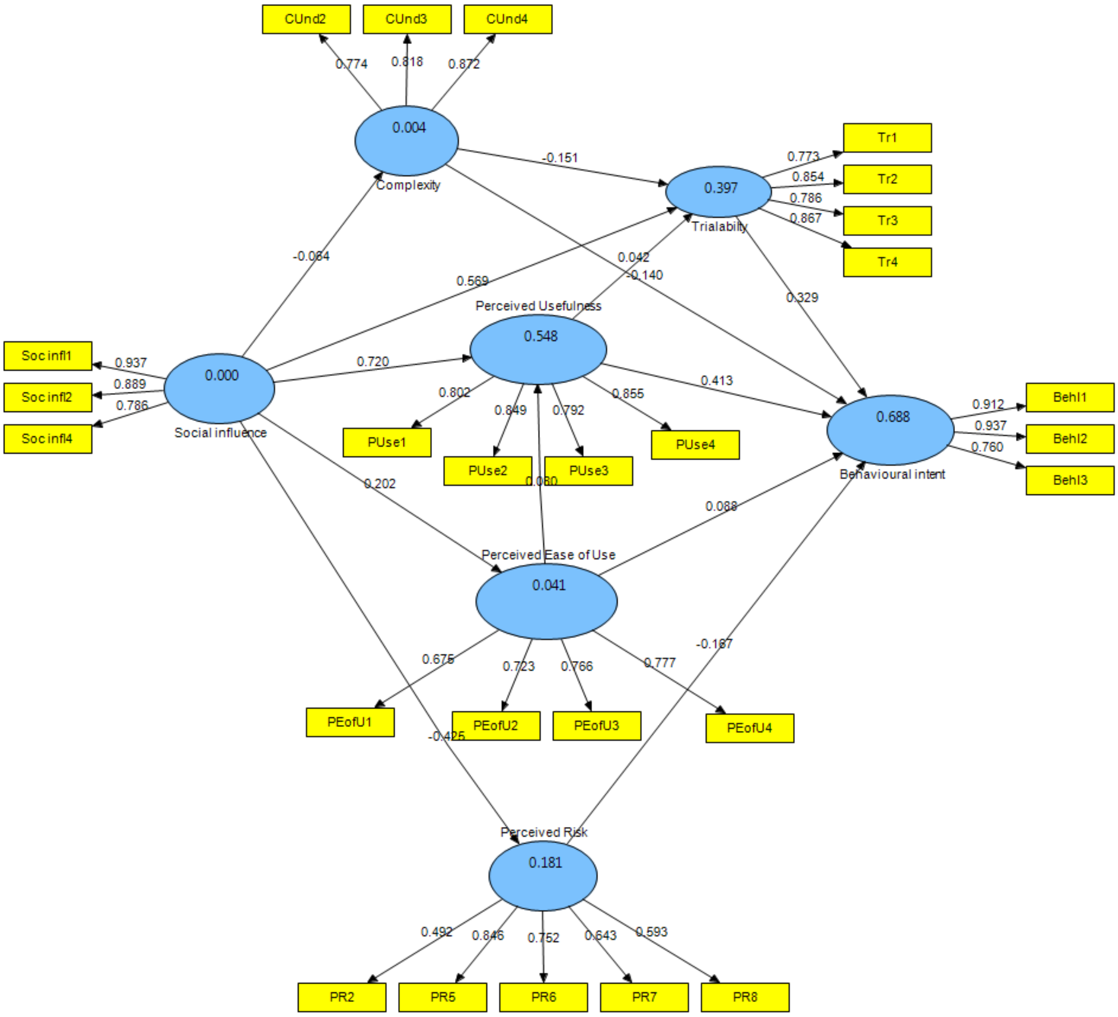

Figure 26: The *a posteriori* Structural Model

The individual R^2 of each latent construct is shown in Figure 26 and Table 24. The R^2 for the complexity of understanding latent construct is 0.004 and is not at an acceptable level and is weak at less than 1%. Thus the variation in complexity of understanding is poorly explained by social influence. The R^2 for the perceived ease of use latent construct is 0.041 and is not at an acceptable level and is weak at less than 1%. Thus the variation in perceived ease of use is poorly explained by social influence. The R^2 for the perceived usefulness latent construct is 0.548 and this moderately high value is considered acceptable.

The R^2 for the trialability latent construct is 0.397 and is not at an acceptable level. The R^2 for the perceived risk latent construct is 0.181 and is not at an acceptable level. The R^2 for the behavioural intent latent construct is 0.688 and is at an acceptable level.

Table 24: Latent Construct R^2

Latent Construct	R^2	Acceptable
Social Influence	-	-
Complexity of Understanding	.004	No
Perceived Ease of Use	.041	No
Perceived Usefulness	.548	Yes
Trialability	.397	Yes
Perceived Risk	.181	No
Behavioural Intent	.688	Yes

The latent constructs of perceived usefulness, trialability and behavioural intent have acceptably high R^2. Thus the variability in the scores reflecting these constructs is explained by their respective predictors to an acceptable extent.

The path coefficients have been analysed in the structural model section. The reliability of the constructs were analysed in the measurement model section. The constructs were shown to be reliable using Cronbach's alpha, AVE and CR. Only perceived risk was below the required recommended value. Each of the hypotheses are summarised in Table 25 and show whether they are supported by the findings, or not.

5.7 Summary

The summary of the hypotheses are presented in Table 25.

Table 25: Hypotheses Summary

Hypotheses	**Path Coefficient**	**T-Test**	**Supported**
H_1: Social influence has a direct negative effect on complexity of understanding	-0.064	t=.286, $p>0.05$	No
H_2: Social influence has a direct positive effect on trialability	0.569	t=2.218, $p<0.05$	Yes
H_3: Social influence has a direct positive effect on perceived usefulness	0.720	t=7.236, $p<0.05$	Yes
H_4: Social influence has a direct positive effect on perceived ease of use	0.202	t=1.321, $p>0.05$	No
H_5: Social influence has a direct negative effect on perceived risk	-0.425	t=3.331, $p<0.05$	Yes
H_6: Complexity of understanding has a direct negative effect on trialability	-0.151	t=.938, $p>0.05$	No
H_7: Perceived usefulness has a direct positive effect on trialability	0.042	t=.205, $p>0.05$	No
H_8: Perceived ease of use has a direct positive effect on perceived usefulness	0.080	t=.664, $p>0.05$	No
H_9: Trialability has a direct positive effect on behavioural intent	0.329	t=2.588, $p<0.05$	Yes
H_{10}: Complexity of understanding has a direct negative effect on behavioural intent	-0.140	t=1.098, $p>0.05$	No
H_{11}: Perceived usefulness has a direct positive effect on behavioural intent	0.413	t=2.887, $p<0.05$	Yes
H_{12}: Perceived ease of use has a direct positive effect on behavioural intent	0.088	t=.712, $p>0.05$	No
H_{13}: Perceived risk has a direct negative effect on behavioural intent	-0.167	t=1.319, $p>0.05$	No

The discussion of the data results will be detailed in the following chapter.

Chapter 6 : Discussion of Results

6.1 Introduction

This chapter will analyse and discuss the results detailed in Chapter 5. The research objectives of this study are to look at the behavioural intent, or adoption, of cloud computing services in larger organisations in South Africa and to develop a media-oriented model which proposed determinants including trialability, complexity of understanding, perceived risk, perceived ease of use and perceived usefulness.

The hypotheses will be tested by reviewing these determinants of cloud computing services adoption. The hypotheses will be presented in numerical order.

6.2 Discussion per Hypothesis

6.2.1 Hypothesis 1

H_1: Social influence has a direct negative effect on complexity of understanding

It was found that social influence has a negative non-significant effect on complexity of understanding shown in the path coefficient value of -.064 (Figure 13). In other words, in the case of the sample considered there was a weak tendency found for stronger social influence to be associated with reduced complexity, but this result cannot be inferred to the target population.

Social influence in the form of mass media, expert commentary and word of mouth does little to reduce the complexity of understanding cloud computing services. However, the premise that social influence would affect the obfuscation and complexity around cloud computing services was overstated in this study. There was no support found for this hypothesis given the non-significant findings of the t-value of .286 (Table 25).

This research was guided by IDT where complexity is regarded as an attribute that determines the rate of adoption. Rogers (1995) recommended that complexity of understanding should be developed in each diffusion study rather than using existing scales from previous studies. Wu and Wang (2005) concur and advise that TAM and

IDT integration may provide a stronger model than either standing alone. Therefore this research postulated that social influence (based on TAM2) has a determining effect on complexity of understanding (based on IDT). Gefen et al. (2000) confirm that PLS is best used for exploratory research. It was with these combined theoretical assumptions and research methodology sanctions that complexity of understanding was added to the proposed model and measured.

The minimal effect on the results could be because almost two-thirds of respondents are already using cloud computing services and the complexity of understanding as a barrier to adopt has become less significant as the life cycle of cloud computing becomes more mature. The social influences of adopting cloud computing services have potentially already permeated into society.

This means that IT decision-makers are already familiar with cloud computing services technologies and the complexities of understanding the services on offer. This rapid unravelling of complexity is faster than anticipated. Technology adoption has potentially speeded up as experts and IT decision-makers collaborate and access pertinent information more efficiently using Internet tools such as social media, online communities of practice and search engines.

The data analysis contradicted the findings of the literature. The hypothesis that social influence has a direct negative effect on the complexity of understanding cloud computing services is not supported.

6.2.2 Hypothesis 2

H_2: Social influence has a direct positive effect on trialability

The path coefficient between social influence and trialability is positive at .569 (Figure 14). The support for this hypothesis could be supported given the findings of the data, including the t-value which was significant at 2.218 (Table 25).

Cloud computing services are well suited to using trialability because the inherent characteristics of the services are on-demand, pay-per-use and try-before-you-buy. Trialability may also be construed as partial adoption, because the user will need to start using the services on a limited and trial basis. Rogers (1995) identified trialability as an attribute of innovation and describes it as the degree to which an innovation may be experimented with before potential adoption. Experimentation – when it comes to using cloud computing services – is accessible almost entirely from the Internet.

However, even if cloud computing services are easily accessible it remains that the IT decision-maker needs to feel comfortable and have the necessary knowledge to access the trial services. This knowledge and education is acquired from the social influences that inhabit the IT decision-makers world. Rogers (1995) believes that most individuals appraise an innovation through the subjective evaluations of close peers who have adopted the innovation and not on the basis of scientific research by experts.

However, Chung and Kwon (2009) state that trialability is perceived to be more significant for early adopters, as well as influencing early adopters' decision-making attitudes. Based on this research and the interpretation it appears trialability may also be significantly impacted by social influences in more mature innovations.

The innovation decision process plays an important factor on the weighting or influence of the determinants. The IT decision-makers have probably moved on from obtaining first knowledge of cloud computing services to forming an attitude toward the services. The IT decision-makers are probably more aware and advanced in adopting cloud computing services than was initially postulated.

This aspect was also witnessed in the previous hypothesis (Hypothesis 1), except that the burgeoning level of large organisations in South Africa that have adopted cloud computing services works in two different ways for Hypothesis 1 and Hypothesis 2.

- Hypothesis 1: Social influence has a no measurable effect on reducing the complexity of understanding because cloud computing has become well known and understandable.
- Hypothesis 2: Social influence has a significant effect on increasing trialability because the more people tell each other about technologies and the more they are exposed via marketing and trade shows – the more they are likely to trial using cloud computing services.

The data analysis supports the findings of the literature. The hypothesis that social influence has a direct positive effect on trialability of cloud computing services is supported.

6.2.3 Hypothesis 3

H_3: Social influence has a direct positive effect on perceived usefulness

The path coefficient between social Influence and perceived usefulness is positive at .720 (Figure 15). The support for this hypothesis could be supported given the findings of the data, including which is significant (Table 25).

The t-value of 7.236 (Table 25) of this hypothesis also shows a significant link between social influence and perceived usefulness. Therefore mass media, expert opinions and word of mouth affects how an IT decision-maker believes using cloud computing services would enhance their job performance, which is a determinant of adoption of cloud computing services.

One of the main constructs in TAM is perceived usefulness, and TAM2 uses social influence as a subjective norm. Wu (2011) found that social influence has a postive affect on perceived usefulness in SaaS adoption. Karahanna and Straub (1999) found evidence that perceived usefulness was determined by social influence.

In other words, IT decision-makers are influenced by advertising, work colleagues and experts. Technologies are often aimed at improving productivity. When productivity translates into improved job performance this becomes desirable to IT decision-makers because part of their function is to reduce costs and increase profitability. IT decision-makers are more likely to respond to societal influences when there are job improvements that are characteristic of a technology.

The link between social influence and perceived usefulness is a potential focus area for marketers. Marketers of cloud computing services may be able to influence a determinant of buying behaviour by designing marketing messages aimed at IT decision-makers perception of job performance enhancement as a result of using cloud computing services.

The data analysis therefore supports the findings of the literature. The hypothesis that social influence has a direct positive effect on perceived usefulness of cloud computing services is supported.

6.2.4 Hypothesis 4

H_4: Social influence has a direct positive effect on perceived ease of use

The path coefficient between social Influence and perceived usefulness is positive at .202 (Figure 16). The support for this hypothesis could not be supported given the findings of the data, including the t-value showing a value of 1.321 (Table 25), which is not significant.

López-Nicolás et al. (2008) found that social influence has a positive effect on the perceived ease of use of technology. This highlighted social networks ability to impact an individual's decision to adopt a technology. The study by López-Nicolás et al. (2008) was centred around mobile phone usage which is a more social tool, and lies in the hands of individuals that share, collaborate and discover the technology in stronger communities.

The potential users of cloud computing services are also exposed to social networks including mass media, experts and word of mouth. However the depth of sharing, collaborating and discovering the technology in a social way is likely to be more limited because the community of IT decision-makers is smaller than the more penetrative technologies like mobile phones or e-mail usage, especially in large scale organisations.

IT decision-makers are constantly involved in evaluating new technologies and software applications as part of their job description. For IT decision-makers technology implementations in large organisations are intricate, time consuming and challenging. This experience, together with the knowledge that organisational technology implementations are reliant on successful change management, project management and infrastructure management may likely influence the IT decision–maker to rely on hard experience, rather than social influences.

The social influences could not be shown to impact an IT decision-makers' belief that using cloud computing services would be without effort, or easy. This is revealing for marketers who may be guided by this discovery to focus on trialability and perceived usefulness, rather than on ease of use of the services.

The data analysis contradicts the findings of the literature. The hypothesis that social influence has a direct positive effect on perceived ease of use of cloud computing services is not supported.

6.2.5 Hypothesis 5

H_5: Social influence has a direct negative effect on perceived risk

The path coefficient between social Influence and perceived risk is negative at -.425 (Figure 17). This could be stated conversely as social influence has a positive impact on security, trust, bandwidth, connectivity and power supply. The support for this hypothesis could be supported given the findings of the data, including the t-value showing a value of 3.331 (Table 25), which is significant.

This research postulated that IT decision-makers' risks in South Africa are partially mitigated based on social influence. Slovic (1987) proffered that risks are subjectively defined by individuals and decision-makers are likely to be influenced by a mixture of social, psychological, institutional and cultural factors. Similarly, Wu (2011) established that social influence has a postive relationship on security and trust.

Security and trust are two perceived risks for cloud computing services in South Africa that are universal concerns. As a developing country South Africa faces subjective risks that are not common in more developed nations. In particular South Africa has expensive and limited bandwidth, poor connectivity and sub-optimum power availability.

The data results show that these risks may be mitigated by social influences. Advertisers and experts have the potential to minimize the perceptions of IT decision-makers when it comes to cloud computing service risks. The media has a propensity of highlighting the positives and reducing the negative characteristics of a product or service.

Social influence has the potential to circumvent risks by attracting industry responses to risks. Some of these industry responses include backup generators, off-the-grid solar power, sea-cable rollouts and fibre optic network rollouts. These responses are both reactive and competitive, but more importantly, also mitigate previously identified risks.

The data analysis therefore supports the findings of the literature and the hypothesis that social influence has a direct negative effect on perceived risk of cloud computing services.

6.2.6 Hypothesis 6

H_6: Complexity of understanding has a direct negative effect on trialability

The path coefficient between complexity of understanding and trialability is negative at -.151 (Figure 18). The support for this hypothesis could not be supported given the findings of the data, including the t-value showing a value of .938 (Table 25), which is not significant.

Premkumar et al. (1994) found that complexity of understanding may discourage the adoption of a new technology. Trialability has previously been compared to partial adoption. The data could not show that the complexity of cloud computing services deterred IT decision-makers from experimenting with the services.

This infers that IT decision-makers are more likely to trial services even though they may seem complex and the services are not well known. IT decision-makers are often technical and are more prone to "play" with technology, especially when it comes at no cost, or very low cost.

The data analysis contradicts the findings of the literature. The hypothesis that complexity of understanding has a direct negative effect on trialability of cloud computing services is not supported.

6.2.7 Hypothesis 7

H_7: Perceived usefulness has a direct positive effect on trialability

The path coefficient between perceived usefulness and trialability is positive at .042 (Figure 19). The support for this hypothesis could not be supported given the findings of the data, including the t-value showing a value of .205 (Table 25), which is not significant.

Wu and Wang (2005) encouraged the integration of TAM and IDT. Perceived usefulness is a main construct in TAM and Davis (1989) defined this as the degrees to how a person believes using a system would enhance their job performance. Trialability is a main attribute in IDT. This exploratory relationship could not be supported with the data.

Importantly, the results show that trialability is a means to an end. The IT decision-makers' performance on the job does not have a positive effect on trialability. This may be because the belief that using cloud computing services would enhance their job performance would come after experimenting with the technology. This relationship is possibly "putting the cart before the horse". Noticeably the impact of perceived usefulness on behavioural intent (Hypothesis 11) is a different indicator of perceived usefulness.

The data analysis contradicts the findings of the literature. The hypothesis that perceived usefulness has a direct positive effect on trialability of cloud computing services is not supported.

6.2.8 Hypothesis 8

H_8: Perceived ease of use has a direct positive effect on perceived usefulness

The path coefficient between perceived ease of use and perceived usefulness is positive at .080 (Figure 20). The support for this hypothesis could not be supported given the findings of the data, including the t-value showing a value of .664 (Table 24), which is not significant.

Davis (1989) defined the following terms:

- Perceived ease of use was defined as to how the same person believes that using the same system would be without effort.
- Perceived usefulness as the degrees to which a person believes using a system would enhance their job performance, and

Lee et al. (2010) confirmed that perceived usefulness is affected by perceived ease of use. This implies that an IT decision-makers' job performance may be positively impacted should cloud computing services be easy to use.

The data shows that the IT decision-maker using cloud computing services with the perception that it is not too difficult to use does not influence their expectation of improving their job performance. This highlights that even when cloud computing services are easy to operate this does not mean that it is going to benefit the users' job performance in relation to these services.

IT decision-makers are used to complex and costly IS applications. The IS applications need to be configured, developed, tested and supported. It is likely that IT decision-makers do not believe that easy to use systems lead to improved productivity. IT decision-makers may also believe that an easy to use system or service is not likely to be a realistic proposition in large and complicated organisational systems.

The findings of the data analysis contradict the literature. The hypothesis that perceived ease of use has a direct positive effect on perceived usefulness of cloud computing services is not supported.

6.2.9 Hypothesis 9

H_9: Trialability has a direct positive effect on behavioural intent

The path coefficient between trialability and behavioural intent is positive at -.425 (Figure 21). The support for this hypothesis could be supported given the findings of the data, including the t-value showing a value of 2.588 (Table 25), which is significant.

Chen, Yen and Chen (2009) found that there was noteworthy influence on the attitude to adopt a technology like cloud computing services when consumers can test and find compatibility with their immediate tasks. Brown et al. (2003) showed that the lack of trialability in South Africa could be a barrier to acceptance of the technology. Cloud computing services have characteristics of trialability because it is a form of service through a software portal that has no value if it is not instantiated or up to date.

The inherent characteristic of cloud computing services is that they can be consumed on a trial and pay-per-use manner. The cloud computing services business model is analogous to a rental model. The powerful combination that cloud computing services have both trialability as an attribute of the services, and trialability has a direct impact on the adoption of the services gives this business model a self-perpetuating advantage. Trialability drives adoption and cloud computing services provide trialability.

Cloud computing services have additional attributes of on-demand and pay-per-use on top of try-before-you-buy. Combined, these attributes could encourage adoption at a faster rate, with greater diffusion than other innovations.

The findings of the data analysis support and contribute to the literature. The hypothesis that trialability has a direct positive effect on behavioural intent of cloud computing services is supported.

6.2.10 Hypothesis 10

H_{10}: Complexity of understanding has a direct negative effect on behavioural intent

The path coefficient between complexity of understanding and behavioural intent is negative at -.140 (Figure 22). The support for this hypothesis could not be supported given the findings of the data, including the t-value showing a value of 1.098 (Table 25), which is not significant.

Premkumar et al. (1994) established that complexity of understanding an innovation could become a barrier to adopting a new technology. The data indicates that IT decision-makers are not outside their comfort zone in understanding cloud computing. The results imply that cloud computing service providers are more mature at educating and unlocking the business value of cloud computing services to consumers by reducing complexity of understanding with comprehensive marketing.

Cloud computing definitions may be in a state of flux; however they do not play as prominent role as the research suggested in preventing adoption of cloud computing services. Large organisations have the technical capacity to digest complex and intricate problems. Although undergoing continual ontology and standards' assessments, cloud computing services remain a potential cost reduction technology. Large organisations are likely to recognise this and use their internal skills to identify how to adopt these services, no matter how complex the technology may appear.

The findings of the data analysis contradict the literature. The hypothesis that complexity of understanding has a direct negative effect on behavioural intent of cloud computing services is not supported.

6.2.11 Hypothesis 11

H_{11}: Perceived usefulness has a direct positive effect on behavioural intent

The path coefficient between perceived usefulness and behavioural intent is positive at .413 (Figure 23). The support for this hypothesis could be supported given the findings of the data, including the t-value showing a value of 2.887 (Table 25), which is significant.

Perceived usefulness was shown to affect behavioural intention in TAM (Lee et al. (2010); Wu (2011) found similar significant positive effects of perceived usefulness on behavioural intent. The data shows that an IT decision-maker believes that enhancing their job performance by using cloud computing services will result in being a reliable determinant to adopting the services.

Enhancing job performance is a clear indicator that productivity is improving. Improving productivity in large organisations has a real benefit, especially if the cloud computing service affects the entire organisation. The cost savings that may be derived from this improved job performance is likely to have major impacts on the profitability and competitiveness of the organisation.

The findings of the data analysis support and add to the literature and the hypothesis that perceived usefulness has a direct positive effect on behavioural intent of cloud computing services.

6.2.12 Hypothesis 12

H_{12}: Perceived ease of use has a direct positive effect on behavioural intent

The path coefficient between perceived ease of use and behavioural intent is positive at .088 (Figure 24). The support for this hypothesis could not be supported given the findings of the data, including the t-value showing a value of .712 (Table 25), which is not significant.

Lee et al. (2010) confirmed that at the core of TAM, behavioural intention is affected by perceived ease of use. Wu (2011) in their study on SaaS adoption found significant positive effects of perceived ease of use on behavioural intent.

Previously it was proposed that large organisations that adopt services need to go through a rigorous selection and project lifecycle in order to adopt cloud computing services. Therefore it may be deemed that no services are easy to use.

SaaS, PaaS and IaaS are combined in this study as cloud computing services. All of these services have varying degrees of ease of use. This may have contributed to a contradiction in the findings.

The findings of the data analysis therefore contradict the literature. The hypothesis that perceived ease of use has a direct positive effect on behavioural intent of cloud computing services is not supported.

6.2.13 Hypothesis 13

H_{13}: Perceived risk has a direct negative effect on behavioural intent

The path coefficient between perceived risk of use and behavioural intent is negative at -.167 (Figure 25). The support for this hypothesis could not be supported given the findings of the data, including the t-value showing a value of 1.319 (Table 25), which is not significant.

Various studies on technology adoption have been completed to support that perceived risks are a barrier to adoption. Tan and Teo (2000) showed that perceived risk is a significant determinant of adoption in an Internet banking study. Brown et al. (2003) found perceived risks to be important determinant affecting mobile banking adoption. Wu et al. (2011) found that perceived risks acted as barriers to adoption in SaaS cloud computing services.

The data shows that IT decision-makers – when confronted with multiple facets of risk – including financial , performance, privacy, psychological and time risk, appear to be less nervous about cloud computing than this study estimated. This implies that the effect of perceived risks including security, trust, bandwidth, connectivity and power availability in a South African context are not as profound as this research hypothesized it to be.

This may be because multi-faceted risks have different layers of importance to IT decision-makers. Risks often become mitigated because organisations see the reduction of these risks as a potential business opportunity. Another reason for this insignificant finding is that different perceived risks may be considered to be of varying riskiness. When combined the perceived risks may be neutralised and minimize a finding result.

The findings of the data analysis contradicted the literature. The hypothesis that perceived risk has a direct negative effect on behavioural intent of cloud computing services is not supported.

6.3 Research Model

The proposed *a posteriori* research model (Figure 26) based on the TAM and IDT model of López-Nicolás et al. (2008), together with the SaaS model of Wu (2011) was assessed and tested using large South African organisations. Social influence was added to impact all constructs to make the model a media-oriented model. At the core are the original determinants of TAM: behavioural intent, perceived usefulness and perceived ease of use. Perceived risk, trialability and complexity of understanding were added to the model.

The most significant R^2 is the .688 of behavioural intent. This shows that a combination of social Influence, complexity of understanding, trialability, perceived ease of use, perceived usefulness and perceived risk can explain approximately two-thirds of the variability in the behavioural intent of the respondents. In other words 68.8% of variability in behavioural intent is explained by the model.

This study attempted to understand the determinants of behavioural intent, or adoption, of cloud computing services in larger organisations in South Africa and to develop a proposed model including variables from related research. Overall, the model was supported by data, although it could be refined in future. Trialability seems to be an important variable in cloud computing services adoption, along with perceived usefulness.

Chapter 7 : Conclusion

7.1 Introduction

This chapter highlights the main findings of the research in a cohesive manner. It reviews the research background and findings, followed by recommendations for stakeholder and managers. The chapter concludes with future research ideas.

7.2 Review of Research Objectives

The research objectives of this study aimed to investigate behavioural intent, or adoption, of cloud computing services in larger organisations in South Africa and to develop a proposed media-oriented model.

The proposed model included variables that other research has found related to adoption of cloud computing services and other technologies such as social influence, trialability, complexity of understanding, perceived risk, perceived ease of use and perceived usefulness.

The variables were included in the model in an attempt to answer the following questions:

- How does social influence affect the determinants of adoption of cloud computing services?
- How does trialability of cloud computing services influence the adoption of these services?
- What effect does lack of understanding, or complexity of understanding, have on the adoption of these services?
- What affect does perceived risk in South Africa – as a developing country – have on the adoption of cloud computing services?

The research findings offer comprehensive answers to these questions raised.

7.3 Research Findings

The results showed that social influence has a direct positive effect on trialability of cloud computing services. IT decision-makers are encouraged by marketing, expert opinions and word of mouth to experiment and trial with cloud computing services. Marketing messages that focus on trialability of cloud computing services are likely to influence this strong determinant of cloud computing services adoption.

The data results showed that social influence has a direct positive effect on perceived usefulness of cloud computing services. Therefore mass media, expert opinions and word of mouth impacts how an IT decision-maker believes using cloud computing services would improve their job performance, which is a determinant of adoption of cloud computing services. Marketing messages that focus on improving job performance are likely to influence perceived usefulness – a strong determinant of cloud computing services adoption.

The results showed that social influence has a direct negative effect on perceived risk of cloud computing services. South Africa has expensive and limited bandwidth, poor connectivity and sub-optimum power availability. The data results show that these risks may be mitigated by social influences. Advertisers and experts may minimize the perceptions of IT decision-makers when it comes to cloud computing service risks. This shows that channelled media can mitigate risks associated with cloud computing services.

The data results showed that trialability has a direct positive effect on behavioural intent of cloud computing services. The attributes of cloud computing services is that they can be consumed on a trial and pay-per-use manner. IT decision-makers experiment with cloud computing services and this increases their likelihood of adopting the technology. This finding may shape marketers media messages to large organisations.

The results showed that perceived usefulness has a direct positive effect on behavioural intent of cloud computing services. The belief that an IT decision-maker may enhance their job performance – or productivity – by using cloud computing services will result in being a reliable determinant to adopting these services.

The results showed that complexity of understanding has no direct negative effect on behavioural intent of cloud computing services. The complexity of understanding as a barrier to adopt cloud computing services becomes less significant as the life cycle of cloud computing becomes more mature. This shows that IT decision-makers are already accustomed with cloud computing services technologies and the complexities of understanding the services offered.

The results showed perceived risk have no direct negative effect on behavioural intent of cloud computing services. All risks are not equal for all IT decision-makers. Risks may also be rapidly reduced in profitable markets like cloud computing services. Examples of mitigating risks include: building private data centres with their own power source and pre-purchasing bandwidth from suppliers with the price built into the services.

7.4 Recommendations for Stakeholders

Marketers and advertisers are continually trying to find an advantage in promoting their services. This research study has identified that IT decision-makers in large organisations in South Africa are positively affected by social influences including marketing messages. This study found that trialability and perceived usefulness specifically can be influenced by social influences. This finding is important because this study also revealed that both trialability and perceived usefulness are determinants of cloud computing services. Therefore these determinants can be altered and enhanced with targeted messages from marketers highlighting the dual pathways of trialability and perceived usefulness.

Marketers are not the only stakeholders that can benefit from this research. Cloud computing service providers may use this study to plan their product roadmap for large South African organisations. The IT decision-maker will more likely adopt the cloud computing service should the benefits offered impact the decision-makers job performance, or productivity. Creating features that readily punt these characteristics are more likely to lead to adoption of the cloud computing services.

Additionally, the service provider should tweak their services to be experimental. Allowing IT decision-makers the ability to trial the software and experiment in a proof of concept arena will more likely result in the adoption, or sale of this cloud computing service. Although cloud computing services are inherently more likely to be trialable, it is imperative for service providers to make trialability more convenient and accessible.

7.5 Recommendations for Management

7.5.1 IT Decision-Makers

Organisations should encourage diffusion of innovations with communities of practice, discussion groups and idea incubators. IT decision-makers and managers must strive to be continually educated and up to date with the latest technologies. The social influence of experts and employees must be harnessed. This could lead to advantages in cost savings and price competitiveness, by being ahead of the curve.

IT decision-makers should pursue trialability with innovations, before committing to technology by using a proof of concept approach to experiment with innovations including services. They should also encourage proof of concept projects, especially if there is a trialability component to the innovation. Trialling with new technologies allows adopters to get the benefits earlier and get to grips with the complexities. It is apparent that adoption rates can be quick and the realised benefits should be taken before competitors.

IT decision-makers should not fear complexity and lack of understanding of technologies. It is evident that the complexity can be unpacked by large organisations into useful portions of information. The benefits that are unpacked can be put to productive use in the organisation.

A technology productivity matrix, based on perceived usefulness, could be implemented into large organisations to score a new technology for adoption. The productivity matrix will apply to all levels of job descriptions in a large organisation. Each person could score the matrix to understand how they believe that using the system or technology would enhance their job performance. This information will give the IT decision-maker a better organisational understanding of the perceived usefulness across the entire organisation, leading to a better adoption decision and adding to a proof of concept business case document.

7.5.2 CEO

CEO's should encourage experimentation with innovations. This allows the organisation to partially adopt the technology without investing heavily before making any decisions that may channel an organisation into a deadlock, or non-fitting technology. The more technologies and systems trialled will lead to better decisions on the final adoption of the technology.

When CEO's survey the external environment and identify perceived risks, they must constantly revisit each risk separately to understand if these risks have been softened or mitigated by organisations filling voids and taking a business stance to address the challenges. One organisation's perceived risks, is another organisation's livelihood.

7.6 Ideas for Future Research

- This study focused on C-suite decision-makers. A large part of cloud computing services may also be used by SME's or individuals. This could be a sample that leads to different insights and results.

- In adoption studies the rate of adoption is significant and can be attempted with a longitudinal study over time. The research approach would be to test the model at certain intervals for a particular innovation. This idea is seeded from the rapid adoption rates shown from the time the IP EXPO Corporate Cloud Survey 2011 (Goldstuck, 2011) study took place in 2011 – compared to this studies research results – less than a year later.

- The research model can be altered by removing the social influence variable – that make this a more media-oriented model – and adding different determinants of adoption to the model for more testing. Similarly, perceived risks could be presented as determinants on a risk-by-risk basis, rather than a combined approach.

- New research could focus on one of the three services (SaaS, PaaS, IaaS) instead of all combined. Each of these services has specific nuances and characteristics that need to be approached differently.

- The research model may be used to understand the determinants of adoption of cloud computing services in other developing countries.

This research contributes to the TAM and IDT research that is on-going in technology adoption. The research model proposed included variables not previously used in understanding technology acceptance for cloud computing services in South Africa.

The research model attempted to explain the variability in behavioural intent and the model shows that it can explain just over two-thirds of the variability in behavioural intent based on scores reflecting trialability and perceived usefulness. This study also successfully identified the dual pathways of trialability and perceived usefulness and their keystone impact because they are affected by social influences and in turn affect the adoption of cloud computing services.

Large organisations in South Africa, and other developing countries, can use this model to understand the impact of social influences on the determinants of cloud computing services, as well as the variables that affect cloud computing services. In addition, the proposed model may be useful for new services understanding of adoption that will become available in the future.

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Appendix A: Sample

No.	Industry	Company	Position
1	Automotive & industrial transport	Dawn	IT director
2	Automotive & industrial transport	Cargo Carriers	Divisional Director: IT and Supply Chain
3	Automotive & industrial transport	Volkswagen Group	Information Services
4	Automotive & industrial transport	Super Group	CIO
5	Automotive & industrial transport	McCarthy Motor Group	Marketing director and CIO
6	Automotive & industrial transport	Kuehne + Nagel	IT Africa
7	Construction & engineering	Bateman Engineering	Head of Group IT
8	Construction & engineering	PD Naidoo & Associates	Acting CIO
9	Construction & engineering	Lafarge Group	Regional IT VP: Africa
10	Construction & engineering	Murray & Roberts	Group CIO
11	Consumer goods & services	Garmin Distribution Africa	CTO
12	Consumer goods & services	Fore Good Group	Technology
13	Consumer goods & services	Estee Lauder	IS manager, EMEA
14	Consumer goods & services	SABMiller	CIO, Africa and Asia division
15	Consumer goods & services	Spier	ICT director
16	Consumer goods & services	Tiger Brands	CIO
17	Education	Boston City Campus	IT manager
18	Education	University of the Witwatersrand	Management
19	Education	CTI Education Group	National IT manager
20	Education	Milpark Business School	IT director
21	Education	Midrand Graduate Institute	IT manager
22	Education	Unisa	Executive director: ICT
23	Education	University of Johannesburg	CIO
24	Education	Open Learning Group	General manager: IT
25	Energy & utilities	Rand Water	Knowledge Management
26	Energy & utilities	Johannesburg Water	CIO
27	Energy & utilities	Umgeni Water	Senior manager: ICT

No.	Industry	Company	Position
28	Energy & utilities	PetroSA	IS operations manager
29	Financial services	Aon Corporation	CIO
30	Financial services	SAICA	CIO
31	Financial services	BancABC	Group CIO
32	Financial services	Absa	Group CIO
33	Financial services	Alexander Forbes	Group IT director
34	Financial services	Zurich Insurance SA	CIO
35	Financial services	Maravedi Group	JD Group
36	Financial services	Indwe Risk Services	Improvement and ICT (CIO)
37	Financial services	Oasis Asset Management	CTO
38	Financial services	Sanlam Personal Finance	CIO
39	Financial services	Clientèle	IT Services
40	Financial services	eBucks	CIO
41	Financial services	Standard Bank	Services
42	Financial services	Fintech	Head of IT
43	Financial services	SA Home Loans	Director: IT and Systems
44	Financial services	Nedbank	CIO
45	Financial services	Johannesburg Stock Exchange	CIO
46	Financial services	FNB Commercial Banking	CIO
47	Health & pharmaceuticals	AstraZeneca	IT
48	Health & pharmaceuticals	Adcock Ingram	CIO
49	Health & pharmaceuticals	Life Healthcare	Information Management
50	Health & pharmaceuticals	Sano?-aventis	IS manager
51	Health & pharmaceuticals	Aspen Pharmacare	CIO
52	Industrial	Omnia	General manager: IT
53	Industrial	Bosal Afrika	IT manager
54	Industrial	Sappi	Group CIO
55	Industrial	Consol Glass	CIO
56	Industrial	Jonsson Group	IT leader

No.	Industry	Company	Position
57	Industrial	Ansys	IT manager
58	Industrial	Barloworld Equipment	IT director
59	Industrial	Illovo Sugar	CIO
60	Industrial	Nampak	CIO
61	Information technologies	Gijima	CIO
62	Information technologies	Dimension Data	Group IT operations
63	Information technologies	Business Connexion	CIO
64	Information technologies	LAWtrust	Solutions director
65	Information technologies	Bytes Connect	Divisional director
66	Information technologies	Innovation Group	CIO
67	Information technologies	Integr8 IT	CEO and CIO
68	Information technologies	Dynamic Technology Holdings	IT manager
69	Media	Avusa	CIO
70	Media	Primedia Broadcasting	Group head: IT
71	Media	MIH	CEO: MIH SWAT
72	Media	SABC	CTO
73	Mining & resources	Exxaro	CIO
74	Mining & resources	Harmony	Group CIO
75	Mining & resources	African Rainbow Minerals	CIO
76	Mining & resources	Sephaku Holdings	IT manager
77	Mining & resources	Central Rand Gold SA	CIO
78	Professional & business services	Deloitte	CIO
79	Professional & business services	Chubb South Africa	IT director
80	Professional & business services	SSI	Group manager, ICT Africa
81	Professional & business services	PricewaterhouseCoopers	CTO
82	Professional & business services	Accenture	CIO
83	Professional & business services	MiX Telematics	CIO
84	Professional & business services	Total Facilities Management	CIO
85	Property & real estate	Growthpoint Properties	CIO

No.	Industry	Company	Position
86	Property & real estate	Broll	IT director
87	Property & real estate	Harcourts International	e-commerce manager
88	Retail	Foschini Group	Group CIO
89	Retail	Clicks Group	Group head of IT
90	Retail	Tiger Wheel and Tyre	Group IT executive
91	Retail	JD Group	Group CIO
92	Retail	Pick n Pay	CIO
93	Retail	Steinhoff	Group ICT Manager
94	Retail	Queenspark	IT director/CIO
95	Telecommunication	ECN Telecoms	CTO
96	Telecommunication	Vodacom Group	IT and billing officer
97	Telecommunication	Blue Label Telecoms	Group CTO
98	Telecommunication	Neotel	CIO
99	Telecommunication	MTN	CIO
100	Telecommunication	Internet Solutions	CTO
101	Telecommunication	Altech Autopage Cellular	IT operations
102	Travel & leisure	Comair	IT Manager
103	Travel & leisure	Peermont	IT Operations
104	Travel & leisure	Legacy	IT Manager
105	Travel & leisure	Southern Sun Hotels	CIO
106	Travel & leisure	Sun International	CIO
107	Travel & leisure	Singer Group	CEO and CIO

Appendix B: Survey Questionnaire

Section A: Demographic Details

Demographics	Categories	Option
Please select the most appropriate level of your position	CEO	o
	CIO	o
	CTO	o
	Director	o
	IT Manager	o
	IT Decision-maker	o
Type of organisation	Financial services	o
	Health and pharmaceuticals	o
	Industrial	o
	Information technologies	o
	Media	o
	Mining and resources	o
	Professional and business services	o
	Property and real estate	o
	Public sector	o
	Retail	o
	Telecommunication	o
	Travel and leisure	o
	Other	o
Size of organisation (number of employees)	1 - 49	o
	50 - 99	o

Demographics	Categories	Option
	100 - 499	o
	500 - 999	o
	1 000 - 4 999	o
	5 000 - 9 999	o
	10 000 or more	o
Age of organisation (in years)	<1 year	o
	Between 1 and 3 years	o
	Between 3 and 5 years	o
	> 5 years	o
Does your organisation use cloud computing services?	...	Yes **o** No **o**
If your organisation does not use cloud computing services, does your organisation intend to adopt these services in the next 5 years?	...	Yes **o** No **o**

Section B: Five-point Likert Scale Questionnaire

No.	Construct	Questions	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Source - Citations
Q1	Social Influence	People around me think it is a good idea for me to use cloud computing services.	1	2	3	4	5	(Campbell, 2007)
Q2		People around me have encouraged me to use cloud computing services.	1	2	3	4	5	(Campbell, 2007)
Q3		The media encourages me to use cloud computing services.	1	2	3	4	5	(Campbell, 2007)
Q4		Experts encourage me to use cloud computing services.	1	2	3	4	5	(Campbell, 2007)
Q5	Perceived Ease of Use	I think learning to use cloud computing services is easy.	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)
Q6		I think finding what I want via cloud computing services is easy.	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)
Q7		I think becoming skilful at using cloud computing services is easy.	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)
Q8		I think using cloud computing services is	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)

No.	Construct	Questions	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Source - Citations
		easy.						
Q9	Perceived Usefulness	I think that using the cloud computing services would enable me to accomplish my organisations tasks more quickly.	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)
Q10		I think that using the cloud computing services would make it easier for my organisations to carry out its tasks.	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)
Q11		I think that cloud computing services are useful.	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)
Q12		Overall, I think that using cloud computing services is advantageous.	1	2	3	4	5	(Edwin Cheng, Lam, & Yeung, 2006)
Q13	Behavioural Intent	I will definitely keep using cloud computing services.	1	2	3	4	5	(Venkatesh, Morris, Davis, & Davis, 2003)

No.	Construct	Questions	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Source - Citations
Q14		I expect to be using cloud computing services in the future as well.	1	2	3	4	5	(Venkatesh, Morris, Davis, & Davis, 2003)
Q15		I think other organisations should use cloud computing services as well.	1	2	3	4	5	(Venkatesh, Morris, Davis, & Davis, 2003)
Q16	Perceived Risk	Cloud computing services may not perform well because of unpredictable electricity supplies.	1	2	3	4	5	(Lee M. , 2009)
Q17		Cloud computing services may not perform well because of lack of adequate bandwidth.	1	2	3	4	5	(Lee M. , 2009)
Q18		Cloud computing services may not perform well because of lack of connectivity.	1	2	3	4	5	(Lee M. , 2009)
Q19		I worry that data transfer costs will be high.	1	2	3	4	5	(Lee M. , 2009)

No.	Construct	Questions	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Source - Citations
Q20		I worry that the financial risk of using cloud computing services will be too high.	1	2	3	4	5	(Lee M. , 2009)
Q21		The potential to lose control of data and the related privacy issues may lead to a loss of status.	1	2	3	4	5	(Lee M. , 2009)
Q22		I would not feel secure about the ability to retrieve data backups.	1	2	3	4	5	(Lee M. , 2009)
Q23		I would not feel secure sending sensitive information using cloud computing services.	1	2	3	4	5	(Featherman & Pavlou, 2003)
Q24	Complexity of Understanding	The confusion around "what is cloud computing services" has delayed my intent to use cloud computing services.	1	2	3	4	5	Exploratory
Q25		It takes too long to learn how to use the cloud computing services to make it worth the effort.	1	2	3	4	5	(Thompson, Higgins, & Howell, 1991)

No.	Construct	Questions	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Source - Citations
Q26		Using the cloud computing services involves too much time doing mechanical operations (for example: data input).	1	2	3	4	5	(Thompson, Higgins, & Howell, 1991)
Q27		Working with cloud computing services is so complicated; it is difficult to understand what is going on.	1	2	3	4	5	(Thompson, Higgins, & Howell, 1991)
Q28	Trialability	I have had a great deal of opportunity to try various cloud computing services.	1	2	3	4	5	(Moore & Benbasat, 1991)
Q29		I know where I can go to satisfactorily try out various uses of cloud computing services.	1	2	3	4	5	(Moore & Benbasat, 1991)
Q30		Before deciding whether to use any cloud computing services, I was able to properly try them out (try-before-you-buy).	1	2	3	4	5	(Moore & Benbasat, 1991)

No.	Construct	Questions	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Source - Citations
Q31		The pay-per-use elasticity of cloud computing services allows for easier trialability of different cloud computing services.	1	2	3	4	5	(Moore & Benbasat, 1991)