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TRUST AND RELATED CHALLENGES INFLUENCING CLOUD COMPUTING ADOPTION BY UK SMES

BY

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ABSTRACT

Cloud computing technology offers flexible, pay-per-use and convenient access to a pool of services and virtualised computer resources using internet connection. Despite these benefits, the adoption of cloud computing by Small and Medium Enterprises (SMEs) is still slow due to (perceived) security and privacy issues. Recent studies concluded that such issues could result in issues of trust for both adopters and potential adopters of cloud computing. While security and privacy issues are actively being researched in the area of cloud computing, there is little published research regarding the aspect of trust between the clients (SMEs) and their Cloud Service Providers (CSPs). The main focus of this study was to investigate the role of trust and other factors involved in the adoption and usage of cloud computing by SMEs. By combining the variables introduced by Diffusion of Innovation Theory (Rogers, 2003), Technology Organisation Environment Framework (Tornatzky and Fleishchner, 1990) and the Integrative Model of Organisational Trust (Mayer, et al., 1995), a conceptual model was produced. This model was tested empirically through an online survey of 269 participants consisting UK SMEs. Using the statistical software 'SPSS', the description of each variable was presented.

The reliability of multi scale items was assessed using Cronbach's alpha. Factor analysis was carried out to reduce the dimensions of items used for further analysis (regression). Then an ordinal regression analysis was done to examine the relationship between variables. It was found that an increase in the challenges of cloud computing decreases its chances of adoption. Also, an increase in the knowledge level of cloud computing was found to increase the chances of adopting cloud computing. On the other hand, trust in service provider was found to have a negative effect on the perceived usefulness of cloud computing. This is because majority of the respondents revealed that cloud computing is very useful but indicated total disagreement of trust in their CSPs. This is not an attractive finding for the CSPs. Therefore, the recommendations provided will enable to CSPs to increase trust in order to encourage the continuous use of cloud computing by adopters and also encourage the uptake of cloud computing by potential adopters.

Keywords: Cloud Computing, Cloud Computing and the SME, Trust and Cloud Computing, Cloud Service Providers and the SME.

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DEDICATIONS

I dedicate this thesis to God almighty for his inspiration, guidance and love throughout this research. I also dedicate this work to my husband, children, parents, brothers and sisters for their encouragements and supports. I remain grateful to them because without their love and supports, I could not have achieved this research.

DECLARATION

I, the undersigned, hereby declare that this dissertation titled "Investigating Trust Issues between Cloud Service Providers and their Clients" is my own, and that all the resources or sources I have used or quoted have been indicated or acknowledged by means of completed references.

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GLOSSARY OF TERMS

CSP…………………..……. Cloud Service Provider.

SME………………...…. Small and Medium Enterprise.

IT………………………. Information Technology.

SLA……………………. Service Level Agreement

OECD…………………...Organisation for Economic Co-operation and Development

IASA………………..…. International Organisation of Software Architects

IMOT…………………...Integrative Model of Organisational Trust

DOI……………………. Diffusion of Innovation

TOE……………………. Technology Organisation Environment

NIST……………………National Institute of Standards and Technology

CHAPTER 1
INTRODUCTION

This This chapter presents research context and rationale for the research, research objectives, research questions, contributions to knowledge, the structure of the thesis and a brief summary of the chapter.

1.1 CONTEXT AND RATIONALE OF THE RESEARCH

SME is a well- known abbreviation which is generally used to refer to Small and Medium Enterprises (Gustafson and Orrgren, 2012). According to the EU-Commission guide to SMEs, SMEs represent a big part of the global economy and in Europe, they represent 99% of all enterprises. For this reason, there are many job provisions within the SMEs. Micro, small and medium enterprises are categorised as a group of enterprises that employ less than 250 persons which have an annual turnover not exceeding EUR 50 million, and an annual balance sheet total not exceeding EUR 43 million (EU- Commission, 2005).

In the United Kingdom, out of about 3.7 million registered businesses, 99.8% have fewer than 250 employees (Lukas, 2005). As recognised by international standards, United Kingdom has a large business population and SMEs play a very crucial role in developing its economy (Collis, 2010). SMEs are recognised as the backbone of the British economy, accounting for more than half of the UK's turnover (Lukas, 2005). SMEs account for 56% of the UK non-governmental jobs and 52% of their turnover (Beaver, 2002). A critical review of bigger companies shows that they all started as SMEs. For example, Microsoft started with a couple of people in a small garage in North-America; Hewlett-Packard started in a little wood shack and Vodafone was once a little spin-off from Racal Electronics Group (in 1982). Volkswagen at a certain point was a small car maker in Germany while Google was started by a couple of young kids with the thoughts of having a good idea (Lukas, 2005).

Today, the competition in the business world has caused many firms to adopt state-of-the-art information technologies (Sultan, 2010). For SMEs to survive, there is a need to develop strategies that will make them become more innovative, effective, profitable and competitive. One of these strategies is the use of appropriate Information and Communication Technologies (Tan, et al., 2009). Although, due to the prevalent nature of computing in the business settings, the management and maintenance of the whole information technology (IT) infrastructure (including software and distributed data) is becoming increasingly complex. As a result, computing has become more expensive than ever before to an organisation (Roehrig, 2009).

Considering the size and structure of the SMEs, they tend to be cost-conscious and as such tend to keep their cost under control. When compared to larger organisations, the cost of bearing risk and adopting innovations for SMEs is less (Tehrani and Shirazi, 2014). SMEs adopt a new technology to gain competitive advantage, but adopting a new technology involves high cost and risk (Amini, 2014).

Many authors have investigated the process of improving operational efficiencies within the SMEs (see Ofili, 2015; Amini, 2014; Sahandi, Alkhalil and Opara-Martins, 2014; Tan, et al., 2009; Tehrani, 2013 etc.). These authors reported that through the use of Information and Communication Technology (ICT), SMEs can gain a competitive advantage over their larger counterparts. Due to the size and structure of SMEs, there is usually fast communication between the employees and their managers, and they usually have the ability to implement and execute decisions rapidly (Tehrani, 2013). However, in most cases these companies face a lot of challenges, and most of these challenges result in their lack of access to enough resources (Amini, 2014).

As explained in the work of Sahandi, Alkhalil and Opara-Martins (2013), cost control is one of the biggest challenges of SMEs towards resource access and it very unlikely for them to spend so much money in deploying Information Technology. Compared to larger organisations, adopting a technology is not very easy for SMEs. Adopting a technology by SMEs gives good competitiveness and facilitates expansion to new markets with new opportunities rising (Gustafson and Orrgren, 2012). Although different organisations adopt technologies based on different circumstances, especially in the mobile dominated world of today.

Over the previous years, several researchers had studied cloud computing (CC) as an advancement in the field of information technology (see Doherty, Carcary and Conway, 2015; Abubakar, Bass and Allison, 2014; Yeboah-Boateng and Essendoh, 2014, Lin and Chen, 2012; Pearson and Bernameur, 2010.).

In this research, cloud computing is defined as an on-demand, pay-per-use, convenient access to a pool of scalable services and virtualised computer resources distributed globally and independently through an internet connection. This definition was based on the cloud computing definition given by the National Institute of Standards and Technology (NIST) (see section 2.2). In the context of this research, cloud computing services refers to business-based models e.g server, storage and applications, which are delivered to an organisation through an internet connection. These are shrouded into Software-as-a-Service (SaaS), Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (Dihal, et al., 2013).

The emergence of cloud computing represents a fundamental change in the way IT services are invented, deployed, scaled, updated, maintained and paid for (Sahandi, Alkhalil and Opara-Martins, 2014). Cloud computing promises to deliver all functionalities of the traditional IT services, then enable new ones by reducing the computing costs which discourage many organisations from deploying many cutting-edge IT services (Staten, et al., 2009). Cloud computing offers pay-per-use services such as database management and mining, storing and sharing of information over web services to both business and non-business sectors (Sultan, 2010). With this pay-per-use model, companies do not need to pay an upfront amount of buying, installing and licensing the system but only pay for the services they use and still have the most sophisticated computing services they require (Tehrani, 2014). Through the use of cloud computing services, companies can have access to computing resources anywhere at any time (on-demand) using of the Internet.

When compared to traditional computing services, cloud computing services facilitate a scalable on-demand computing power, rapid deployment and reduced support infrastructure while facilitating lower cost of ownership (Aymerich et al., 2008). Its operational responsibility (hardware maintenance and software upgrade) is given to the Cloud Service Providers (CSPs). For the purpose of this research, a CSP refers to a vendor or company responsible for providing cloud services to cloud service users. The vendor hosts and provides all necessary IT infrastructure needed for cloud service offerings. This provider can also host another hosting provider (Dargha, 2009).

In cloud computing, cloud users do not need to install computer resources in-house. They only use the services provided by the CSPs (via internet connection) then pay for it. The cloud service user refers to an individual or enterprise using the cloud services provided by the CSP. The pay-per-use model of cloud computing is another significant difference between cloud computing and traditional computing. In this research, clients/users of cloud computing are small and medium enterprises (SMEs).

Cloud computing is considered an innovation because it offers a new method of computing by integrating the already existing technologies (Ofili, 2015). Cloud computing offers flexibility, scalability, cost reduction and many other benefits to organisations especially the smaller ones (Tehrani, 2013). Flexibility has been repeatedly shown to be a key component of effective business management (Swafford, et al., 2006). In addition to flexibility, cloud computing technology is not limited by specific configurations, particular service providers or specialised uses. Rather, it is a type of innovation that may be employed in many different fashions and forms by various members of different organisations. This makes it even more useful in the business context (Tan, et al., 2009). The benefits of cloud computing enable businesses to grow larger, become more productive, innovative, gain competitive advantage, access sophisticated technologies while focusing on their core business activities, without spending significant amount of money (Tehrani and Shirazi, 2014).

In the 2014 report of Cloud Industry Forum regarding the adoption trend of cloud computing by UK businesses, it was shown that there has been a steady increase in adoption since their 2010 survey. This report mentioned a 48% usage increase in 2010, which increased to 53% in 2011, 61% in 2012, 69% in 2013 and 78% in 2014. This report suggests that broken down by size, larger organisations are more likely to adopt cloud computing than their smaller counterparts (SMEs). It was also stated that 96% of larger organisations (having more than 200 employees) are using at least one cloud service compared to 76% of those below this threshold.

In November 2014, another survey was conducted by Eurostat on the use of cloud computing services by enterprises. The survey consisted of 151,000 enterprises from the EU-28 countries, and it was reported that only 19% are SMEs that use cloud services compared to 35% of those who are large organisations (Giannakouris and Smihily, 2014). This report mentioned that security issues and insufficient knowledge of cloud computing influenced the percentage of cloud computing usage by enterprises. The enterprises used in this survey ranked security as the top barrier to cloud adoption, with 57% from larger organisation and 38% from SMEs. It was also stated that one in 3 SMEs already using cloud computing reported that insufficient knowledge or expertise may limit the uptake of cloud computing by potential adopters.

Inferences from recent literature suggest that adoption and usefulness of cloud computing was still an issue to SMEs even up to 2015 (please see Ofili, 2015, Doherty, Carcary and Conway, 2015; Sahandi, Alkhalil and Opara-Martins, 2014; Tehrani and Shirazi, 2014 and Carcary, Doherty and Conway, 2014). These studies explained that despite the benefits of cloud computing to SMEs, adoption and continued use of cloud computing have been influenced by issues related to security, privacy, data location, malicious insider, availability of data, service level agreement and other legal concerns. In their studies (Huang and Nicol, 2013; King and Raja 2012 and Kok, 2010), these issues were addressed mainly as security and privacy issues. Although, Giannakouris and Smihily (2014) explained that the risk of security breach and privacy issues may be a matter of the service provider's reliability and accountability which may lead to a lack of trust in the service provider.

Following the recent Intel Security survey of cloud adoption trends and attitudes by IT professionals, a report was released advocating the need for technology vendors to help businesses, consumers and government to understand the implication of cloud adoption. With 77% of participants noting that their organisation trust cloud computing over a year ago, only 13% completely trust their cloud service provider to secure their sensitive data (IntelNewsroom, 2016). These findings highlight that improved trust on service providers is very important in encouraging continued adoption of cloud computing. Many studies in this area have observed the issues of security, privacy and trust when cloud computing resources are given to and managed by a third party (see Dihal, et al., 2013; Pearson and Bernameur, 2010)

To understand the adoption of cloud computing by SMEs, the question of trust in cloud service providers becomes imperative. Trust is a significant factor in every business relationship. In cloud computing, trusting the service provider will play an important role in enabling SMEs to realise the benefits that cloud computing has to offer. Different perspectives of trust issues and challenges have been widely discussed in the area of cloud computing (e.g Aberer, et al., 2012; Khan and Malluhi, 2010 and Pearson and Benameur, 2010) but none of these studies discussed trust as an issue affecting the relationship between the CSPs and their clients, which in turn affects adoption and usage of cloud computing.

Based on this body of knowledge, a gap was identified to investigate the issue of trust between cloud service providers and their clients (SMEs), factors that influence the adoption of cloud service and the role of trust in the adoption of cloud services. The following are the research objectives.

1.2 RESEARCH OBJECTIVES

1. To identify factors which encourage or inhibit the adoption of cloud computing by SMEs.
2. To investigate whether any of the factors mentioned above has any influence on the adoption or perceived usefulness of cloud computing.
3. To research into the role of trust in cloud computing adoption.
4. To develop and validate a conceptual model which can be used to study SME's adoption of cloud computing services.

5. To discuss how the model can be practically used (by SMEs, Cloud Service Providers and the research community) to study the stages of cloud adoption and how it can be applied to other new technologies or innovations.

1.3 RESEACH CONTRIBUTIONS

1.3.1 ORIGINALITY

This research suggests that although cloud services possess the ability of offering many benefits, but there are many challenges which influence cloud computing adoption and usefulness by SMEs. These challenges relate more to issues with cloud service providers. For example, lack of privacy of data, malicious insider with the CSP's organisation, loss of control of service, lack of confidentiality of data, service level agreement issue etc. As argued by many researchers (see Aberer, et al., 2012; Ko, et al., 2011 and Pearson and Benameur, 2010), these issues could lead to a loss of trust in cloud service providers.

This study identified a gap in literature which relates to the role of trust in cloud computing adoption by UK SMEs. Although previous studies proffered various factors that encourage or inhibit the adoption and usage of cloud computing, this study positions trust as a significant factor for cloud service usage and adoption by SMEs in UK. In this research, trust was operationalised using the factors of perceived trustworthiness introduced by Mayer, Davis and Schoorman (1995). These factors were presented in three dimensions (ability, integrity and benevolence), which are regarded as the key attributes of the service provider that inform their clients' trust in them. Trust being in the vanguards of research in many fields, relating it to cloud computing and especially between the service providers and their clients, is a significant research contribution. Secondly, the extent that this study offers a new point of view in cloud computing adoption, by redirecting attention to the well-researched factors that influenced cloud adoption to trust, is another significant contribution.

Following criticism of similarities, repetitiveness and limitations of current ICT adoption research (see Williams, et al., 2009), this study developed a theoretical model that holistically explains the process of adopting cloud computing by SMEs in the UK. The model integrated trust and other technological, organisational, environmental and individual factors to better explain the adoption process of cloud computing adoption, and its subsequent usage by UK SMEs. This model consists of several variables that explain the stages of making a decision towards cloud adoption. Majority of the variables introduced in this model were adapted from three prominent theories and frameworks in the field of trust and technology/innovation acceptance. Two of these theories are the Diffusion of Innovation (DOI) Theory (Rogers, 1995; 2003) and Technology Organisation Environment (TOE) Framework (Tornatzky and Fleischer, 1990). Both the DOI and TOE have been well studied in the area of innovation and technology adoption. The third model is the Integrative Model of Organisational Trust (IMOT) (Mayer, Davis and Schoorman, 1995; 2007). The IMOT has also been well studied by many researchers of trust in organisational settings (see chapter 4 for full details of these models). Variables introduced in these models were adapted and considered suitable to this research context. The model was empirically validated using an online survey (see chapter 6 and 7 for further details).

1.3.2 PRACTICAL CONTRIBUTIONS

The practical contributions relate to the effective use of the model by both SMEs and CSPs, to better understand the stages of adopting cloud computing. Also, the model will be of great value to ICT suppliers, managers and consultants in terms of developing suitable strategies for ICT adoption. Since the model also considers the involvement of stakeholders in the decision-making process, it would be of great use to policy and decision makers. By considering all the factors specified in the research model, they would be able to make proper decisions and policies. For the research community, the model will help in studying the key factors involved in the adoption of cloud computing which can be applied to other technological innovations. Any experience gathered from the use of this model to understand cloud computing adoption, can be transferred when trying to understand the adoption of other innovations. The results of this research have contributed significantly to the field of this study. Based on the contributions above, there is no doubt that the research is appropriate and timely.

1.4 THE THESIS STRUCTURE

The rest of this thesis are organised as follows: Chapter 2 presents a discussion on related literature and identified benefits and challenges of cloud computing. Chapter 3 discusses the concept of trust and its operationalization in this research. Chapter 4 presents a discussion on the different theories that relate to technology acceptance, those selected for the study and their justifications. Chapter 5 gives a full detail of the conceptual model developed for the study, its variables and hypotheses developed for the study. Chapter 6 consists of the research design and methodology. It explains the data collection procedures with detailed justification of the choice of methods. Chapter 7 focuses on all the procedures used for analysing the data and the statistical findings. Chapters 8 presents the discussion of findings from the study, a reflection on research objectives and hypothesis as well as the implications for the study. Chapter 9 discusses the study conclusions, limitations and future studies.

1.5 CHAPTER SUMMARY

This chapter explained the research context in details as well as the justification for choosing to do the study. The research objectives were given to define the scope of the research. Also, the research questions were clearly stated out. The structure of the thesis was also given. This briefly explained what has been given in the rest chapters of the thesis. The following chapter will discuss the review of literature relating to the research.

CHAPTER 2

LITERATURE REVIEW

This chapter examines the general concept of cloud computing and issues relating to its adoption by SMEs. It begins with the concept of cloud computing, definition of cloud computing, cloud deployment models, characteristics of cloud computing followed by cloud service models. Then the benefits and challenges of cloud computing, as well as a summary table of previous studies on challenges of cloud adoption were discussed. The last part of this section consists of a review of previous studies relating to the adoption of cloud computing by SMEs. This chapter was written to explore cloud computing in a broader context in order to provide answers to the research.

2.1 CLOUD COMPUTING CONCEPT

According to Fowler and Worthen (2009), the cloud was being used in the late 1990s to represent everything that relates to the internet. The word "cloud computing" was first used during the Search Engine Strategies Conference in San Jose in 2006, when Google's former CEO Eric Schmidt tried to describe the history of computer architecture and internet (Limet, Smari and Spalazzi, 2015).

According to Marston, et al. (2011), Amazon became the first company to offer cloud services (virtualised data storage space and server access) to its customers hence officially accredited with the phrase "Pioneers of Cloud Computing". It all started in 2006 when they updated their datacenters to handle peak periods in order to subsequently improve internal efficiency (Westervelt, 2009). They realised that a lot of resources were unused after their newly implemented network architecture, then decided to open those resources for organisations and businesses to hire on demand. They initiated this idea by providing cloud services to their external customers and launched the Amazon Web Service (AWS) on a utility computing basis. Westervelt revealed that ever since then, Amazon has been making some heavy investments in this area of computing. Following the above development made by Amazon, other big IT-related companies (e.g Google and Microsoft) now offer similar services (Fowler and Worthen, 2009). The concept of cloud computing is not new, it is a combination of existing technologies such as virtualisation, centralised, distributed and utility computing (Zang, et al., 2010). This combination of several existing technologies into a network platform, makes cloud computing a novel concept (Weiss, 2007).

2.2 DEFINITION OF CLOUD COMPUTING

Even though a lot of people assume that a good number of professionals in business technology and IT industries are familiar with cloud computing concept, there is still confusion in the actual definition of cloud computing (Mullan, 2010). Please see the appendix section for a summary of the different definitions of cloud computing stated by the Global IT Architect Association (IASA) Sweden in 2008 (Vaquero, et. al., 2008).

Since the emergence of cloud computing in 2006, it has become one of the essential technologies considered by many business organisations (Gartner, 2006). In simple terms, cloud computing is the outsourcing of IT resources (Babcock, 2010). Irrespective of the different definitions of cloud computing, the proposed NIST definition is the most widely accepted and recognised definition of cloud computing (Vaquero, et. al., 2008). Specifically, cloud computing was defined by NIST as ‘a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service providers’ interaction’ (Marston, et al., 2011). Figure 1 below illustrates the NIST definition of cloud computing. It consists of four cloud deployment models, five essential characteristics and three cloud service models.

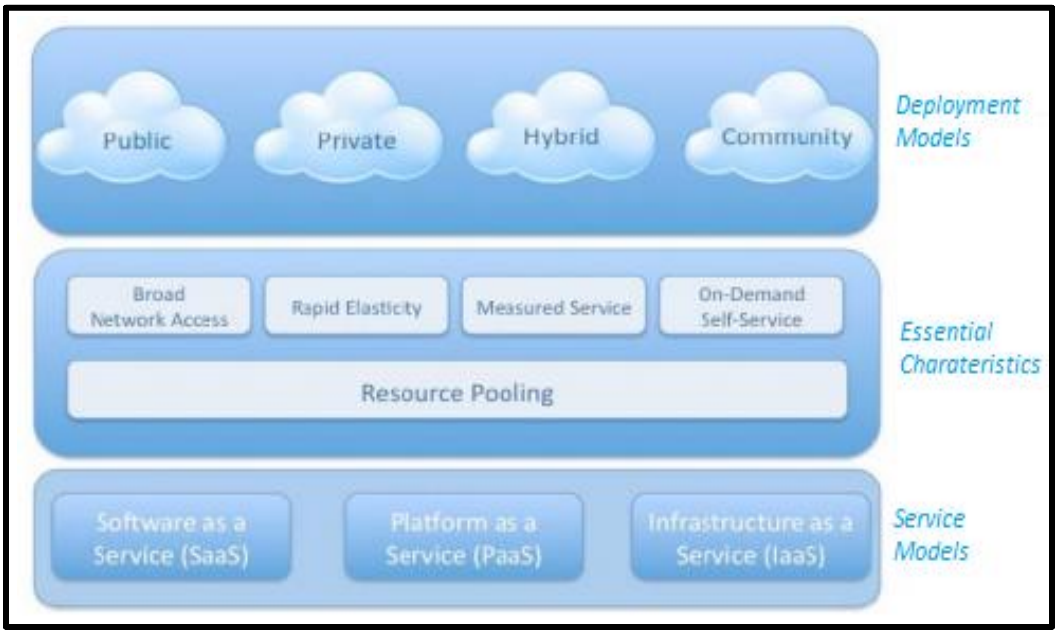

Figure 1: NIST Cloud Computing Definition Framework (Mell and Grance, 2009; 2011)

2.2.1 CLOUD DEPLOYMENT MODELS

As stated in Mell and Grance (2009; 2011) and Kok (2010), cloud computing deployment models include:

- **Private Cloud:** This type of cloud model is used by a single organisation. This organisation may decide to host the infrastructure on or off its premise. Private clouds are regarded as being trusted compared to other cloud service models. Private clouds can be owned and managed by an organisation, a third party or both. In other words, private clouds are used by private companies, public sector organisations and government bodies for usage within closed user groups. Such clouds are not accessible to the public.
- **Public Cloud:** Public cloud provides massive scale cloud services to members of the general public. The infrastructures are resident on the CSP's premises. It may be free or offered through a pay-per-use model. The cloud resource is available through the internet. Clients of these service model can select and assign the security and service level they require (Dustin, et al., 2010; Amini, 2014).
- **Community Cloud:** According to Dustin, et al. (2010), the community cloud model is specifically used by users within a community who have related concerns and expectations (e.g. Policies, goals or security requirements). The community cloud is usually perceived to be trusted by organisations within that community. It can be owned and managed by one or multiple organisations in that community, a third party or a combination of both. The infrastructure can be hosted on or off the premises of the organisations.
- **Hybrid Cloud:** This consists of two or more clouds with each maintaining its own special features which are bound by standardized or proprietary technology (Brunette and Mogull, 2009). They are put together to provide the functions and benefits of a combined deployment model.

2.2.2 CHARACTERISTICS OF CLOUD COMPUTING

In the NIST report titled "definition of cloud computing (draft)", the following are vital characteristics of cloud computing also listed in the NIST cloud computing definition framework (figure 1 above) (Mell and Grance, 2011).

- **On-demand Self-service:** This explains the unilateral provisioning of computing capabilities (e.g. server time, applications, storage etc.) to users without service providers' effort or interaction.
- **Resource Pooling:** This involves the use of CSP's computing resources to serve several end users through the use of a multitenant system, having different virtual and physical resources dynamically assigned and reassigned to meet the demands of each end user.
- **Rapid Elasticity and Scalability:** Enables several functionalities to be rapidly, automatically and elastically provisioned (released) in some inward and outward proportions according to customers' demands. To consumers, the resource provisioning capabilities often appear unrestricted and can be used however and whenever they want.
- **Broad Network Access:** Cloud services are available through the internet and accessed by means of standardised mechanisms using heterogeneous thick or thin client (e.g. laptops, tablets, workstations etc.).
- **Measured Service:** In cloud computing, there is an automatic control and optimisation of resource usage. This is possible because of its provisioning of metering capabilities at some level of abstraction, depending on the type of service (e.g. active user accounts and bandwidths, storage, processing etc.). Resource usage can be monitored, controlled and reported to provide transparency for both the service provider and users of the utilised service.

2.2.3 CLOUD SERVICE MODELS

Cloud service models are used to describe the different services that can be obtained in the cloud. The criteria for these services depend on customers' requirements (Lin and Chen, 2012). The three major cloud service models are explained below.

- **Software as a Service (SaaS):** This service provides cloud users with a wide range of access to applications from several networked devices. The applications are rented out to users over a subscripted time (pay-per-use). The applications and the cloud infrastructure in which they operate on are owned and managed by CSPs (Mell and Grance, 2011). Mell and Grance further revealed that SaaS refers to the renting of both applications and infrastructure totally managed by service providers through a web client (e.g web-based email, Google Docs, MobileMe and Zoho).

The entire infrastructure is located in datacenters. SaaS allows a company to pay a monthly fee to purchase the services (Levinson, 2010). Some examples of SaaS are Google Apps and Microsoft Office 365 (Rimal, et al., 2009).

- **Platform as a Service (PaaS):** This service is related to SaaS. It provides users with the ability to rent infrastructure so as to get a platform to build their own applications. These applications are built with programming tools and in a format supplied by the provider. The provider manages and controls the cloud infrastructure, while the client is allowed to control the application-hosting environment configuration settings and their deployed applications (Krutz, 2010). As stated in Cloud Security Alliance Report (2010), the main difference between SaaS and PaaS is that SaaS allows the users to customise a software to fit their business purposes while PaaS gives room for maintaining the application in a customised way (Bardin et.al, 2009). Krutz (2010) also explained that PaaS provides a good option for organisations whose applications need a better platform to work with if there are unsupported resources within the organisation. The organisation can hire the necessary infrastructure needed to support the applications fully. Examples of PaaS are Force.com, Microsoft Azure, AWS Elastic Beanstalk and Google App Engine (Rimal, et al., 2009).
- **Infrastructure as a Service (IaaS):** The IaaS builds upon PaaS and SaaS. It offers users the ability to outsource basic computing resources (networking components, storage etc.) that are to be used in their operations. Users have control over the deployed operating system, applications and storage while the CSPs are responsible for the management and control of the cloud infrastructure (Krutz, 2010). IaaS users pay for the provider's hardware each time they use it. Examples of IaaS include Rackspace Mosso, Windows Azure, Amazon EC2, Google Compute Engine, Terremark cloud offering and Sun's cloud services (Rimal, et al., 2009).

Since the emergence of cloud computing in 2006, it has become a top technology priority for many business organisations in the world (Carcary, Doherty and Conway, 2014). According to the report of some leading industries (e.g. Forrester), cloud computing is estimated to hit the market figure of $241 billion by 2020 (Trend Micro, 2011). A lot of researchers have investigated the drivers and barriers to its adoption by business organisations (Alshamaila and Papagiannidis, 2013; Aljabre, 2012, Johnson, 2011; Low, Chen and Wu, 2011; Armbrust, et al., 2010, Iyer and Henderson, 2010 etc.). Research into related literature reveals some benefits and challenges of cloud computing adoption, which are discussed below.

2.3 BENEFITS OF CLOUD COMPUTING SERVICES TO SMALL AND MEDIUM ENTERPRISES.

As mentioned in the work of Alsanea (2015), SMEs are faced with resource poverty when compared to larger organisations. In other words, they have restricted access to both technical and in-house legal knowledge which prevent them from enjoying the benefits of latest technology and operation services. SMEs operate in a time-constrained environment which provides the avenue for employees to work overtime in order to achieve their desired goals (Tehrani and Shirazi, 2014). Cloud computing emerged to provide many cutting-down cost benefits to SMEs.

From a customer's view point, cloud computing delivery model offers a decrease in capital expenditure, quickens return on investment, enhances IT dexterity and a more vigorous infrastructure which leads to better business posterity (Amini, 2014). From the present digital business aspect, cloud services present favourable opportunities for SMEs to cooperate within themselves thereby creating a new competitive advantage (Petrakou, et al., 2011).

According to Staten, et al. (2009), cloud computing promises to deliver all functionalities of the traditional IT services and enable new ones, by drastically reducing associated computing costs which discourage many organisations from enjoying the benefits of many cutting-edge IT services. It provides many firms with easier access to hardware resources and more storage devices (Marston, et al., 2011).

Cloud computing offers services such as information sharing and storing, database mining and management over the web to businesses who adopt it on a pay per-per-use format (Sultan, 2010). This is particularly true for SMEs. Cloud computing is potentially beneficial to SMEs by helping them enhance their operational efficiency, become more productive and focus more on their core business aspects (Sahandi, Alkhalil and Opara-Martins, 2013).

When a company's IT sector is outsourced to a service provider, the company will have a reduced cost of hiring IT staff and also be relieved of the associated technical complexities involved in IT services. As a matter of fact, the amount of time, efforts and resources involved in the IT departments are managed by the CSP thus enabling the company to focus more on their core business functions, rather than having to worry about upgrades or their information system maintenance (Ashford, 2008). This also holds true for SMEs that do not belong to the

IT sector. As a matter of fact, cloud computing services can be accessed through the internet which makes it easily accessible and quick to use (Clark, 2009).

Cloud computing offers agility. In this regard, Tamburri and Lago (2011) explained that when using the cloud computing option, there is no need to purchase and manually setup hardware. Also, cloud users can easily scale up or down based on their needs. Cloud Computing is flexible to use. Since there is high level of adaptability, people can decide whenever they want to use cloud services (Amini, 2014).

2.4 GENERAL CHALLENGES OF CLOUD COMPUTING

Kok (2010) reveals that despite the potential opportunities and benefits of cloud computing, there are still issues preventing organisations from adopting the service therefore reducing the adoption rate of the technology. It is only possible to overcome the barriers faced by organisations in adopting cloud services if the barriers are identified and resolved.

According to Brodkin (2009), organisations (both government and private) are sceptical in the adoption of cloud technology for the fear of immaturity of the technology and providers not being able to provide proper security of customers' sensitive data.

As mentioned by Condon (2013), Vanson Bourne on behalf of Cloud Industry Forum carried out a survey using 450 managers from both public and private companies. In this survey, they investigated the reasons why companies hesitate to adopt cloud services. In this study, 64% of the respondents mentioned data security issue, 62% mentioned privacy issue, 50% mentioned dependence on internet access, and 38% indicated doubts over supplier reliability, while 35% indicated contract lock-in. This research also showed that data location appears to be another barrier to cloud adoption by the surveyed companies. Companies with less than 20 employees showed more concerns than larger companies, which always have greater resources to help them manage the risks.

Among the many different barriers to cloud adoption faced by business organisations, hidden costs, privacy, security, vendor / risk management and trusting the CSPs appear to be the most prominent ones. These have been discussed in details below.

2.4.1 HIDDEN COST CONCERNS

Hidden cost concerns are usually associated with the costs that relate to internet services subscription, networking requirements, computers hardware-related costs, software-related costs, etc. (Hutchings, Smith and James, 2013).

According to Venkatraman, (2013), some hidden deployment and management costs are some reasons why SMEs continue to stay away from adopting cloud services. The cost of deployment doesn't just lead to this hesitation but the hidden charges that come up while the service is already running. These charges are associated with the major expenses involved in deploying cloud computing. Going beyond the initial set-up, elements like security, networking, application, storage, back-up services, redundancy and operating system licenses are included in these charges. They are also associated with complicated backups, extensive recovery and unauthorised use of the service by employee (Venkatraman, 2013).

2.4.2 SECURITY ISSUES

AlZain, Soh and Pardede (2012) reported that security is one aspect of computing that holds immense importance. Security concern have been another reason slowing down the adoption of cloud computing by SMEs. These security challenges include data ownership, preservation of confidentiality and privacy, and most of all reliability (Pearson and Benameur, 2010). Apart from these, there are issues of accountability, auditability, confidentiality and trust in service providers (Zhang, Cheng, and Boutaba, 2010). Issues of cloud security also extend to data transmission, data storage and third party data access (Subashini and Kavitha, 2011). Hacking or identity theft appears to be another security threat for SMEs towards cloud adoption (Chorafas, 2011).

As a result of storing big business data in the cloud which are managed and controlled by CSPs who have unlimited access to it, there are questions of data security and third party access (AlZain, Soh & Pardede, 2012). SMEs can't just be sure whether or not CSPs can be trusted to manage their data through the cloud computing system.

Some researchers revealed that cloud computing is slowly gaining popularity within the SMEs but the fact that their mission-critical assets and data are entrusted to a CSP results in security concerns (Lynn, 2013). Lynn also mentioned that SMEs worry about their data integrity, confidentiality, privacy and accessibility.

In the course of investigating the threats to cloud adoption by businesses, Aleem and Sprott (2012) interviewed about 200 professionals from the ICT sector all over the world. Out of the concerns mentioned, security issues appeared to be 93.4%. Security issues appeared to be more of a concern than data loss and leakage (73.5%), account, service and traffic hijacking (60.8%), governance (62.3%) and lack of control over service availability (55.7%). This research showed that 17% of the participants' organisations were already using cloud services while 8% out of those 17% mentioned that they have had experiences of security breach in the cloud.

Another research by Trend Micro (2011) reported that out of over 1,200 companies surveyed worldwide, 43% indicated that in the past one year they had experienced security issues with their service provider.

According to Pacella (2011), on several occasions incidents that took place within the CSP's organisations were ignored and never reported by the CSP. A majority of these attacks tend to be undetected (Blumenthal, 2011). Pacella also revealed that in cases where they are detected and made public, the CSPs either deny or argue that such data was never held in their cloud system. This is because they do not want to lose potential clients so they withhold any detail leading to such information.

2.4.3 SERVICE AVAILABILITY AND RELIABILITY ISSUES

Even though CSPs are regularly introducing innovations in order to enhance their uptimes, service disruption is another problem they battle with (Blumenthal, 2011). Blumenthal explained that lack of availability of service is strong enough to dissuade a good number of SMEs from adopting cloud service. Lack of reliability of service can be attributed to improper authentication mechanism. Cloud computing system provides the possibility of unauthorised access by obtaining users' logging details without proper authorization (Dlodlo, 2011). There are different technical and non-technical means of doing it.

An example of these issues was reported in Dlodlo's example of password guess using keylogging malware, achieved through weak password recovery techniques (e.g. a security question) that can be cracked or acquired when an account is not signed out. Lack of proper authentication checks cannot always be attributed to the intention of indulging in malicious activities. Dlodlo mentioned that there have been occasions where mistakes of the providers come into play. For example, in June 2011, Dropbox left its site open for four hours for some inadvertent reason (Wright, 2011). This provided a possibility for anyone to log-in into several Dropbox users' account using random passwords.

2.4.4 AUTHENTICITY AND OWNERSHIP ISSUES

SMEs have a great concern regarding the modification of their important data in a cloud system (Behl and Behl, 2012). Authenticity and ownership issues are related to the issues of data integrity and confidentiality, where clients worry that those with malicious intents will have access to their data. Cohen (2012) gave an example of a situation where customers' data were compromised as a result of issues relating to rights and privileges associated with data ownership. Cohen explained that these issues can happen sometimes because of the type of rights or privileges given to certain users in a commonly shared database setup. For this reason, SMEs are faced with questions likes "what will happen if we stop subscribing to the cloud service?", "will we still have access to our data?", and "what is our right if our data is compromised or stolen from the CSP's storage device?". Cohen mentioned that not many providers have been able to answer these questions, which is perhaps one reason why SMEs stay away from adopting cloud computing.

In terms of storing sensitive and proprietary data in an external environment (e.g. the cloud computing system), obvious risks are involved and these have resulted in some form of scepticism for SMEs towards cloud computing adoption (Behl and Behl, 2012).

Grobauer, Walloschek and Stoecker (2011) stated that in the cloud computing environment, users are sometimes faced with the issue of insufficient or faulty authentication checks, which gives room for URL guessing attacks whereby direct webpage access is gained through page links. No matter how these security breaches are performed, they tend to have very negative impact on the customer whose important data have been accessed.

2.4.5 CUSTOMER LOCK-IN

Customer lock-in appears to be another barrier to cloud adoption by SMEs (Gens, 2008). This reflects in Gen's example of customers not being able to switch between CSPs because there is no standardised or pre-fixed format of data storage provided by the CSP. In a typical cloud computing scenario, the CSPs create the formats of storing customers' data in the cloud and this varies between CSPs (Gens, 2008). This could lead to a loss of customer's data or have a substantial damage to it if care is not taken. Gens explained that customer lock-in situation is particularly channelled towards benefiting the CSP and not the customer. According to Sultan (2011), the provision of cloud computing service is more of a monopoly-based. The issue of customer lock-in could cause major problems to the customer (in this regard SMEs) if their data is damaged or lost. This is because these services are available through proprietary software with insufficient standards. In essence, portability has continued to be a problem for SMEs towards the adoption of cloud computing. Similar to individuals, SMEs like to enjoy service migration where they have the freedom to move in and out of a system without the stress of dealing with such issues.

2.4.6 CONTRACTUAL ISSUE

Contractual issue is another significant factor preventing SMEs from adoption cloud computing services in their business (Linthicum, 2013). Linthicum mentioned that cloud computing service contracts are designed on the basis of "take-it or leave-it" where the CSPs are protected against any and every possible risks. In other words, any resultant risks or liability are placed on the customer. Compared to big organisations, SMEs may not be able to afford seeking legal services to defend such one-sided contract in case of any problem instead they stay away from adopting the service. The worst part is that negotiation cannot be made with anyone because these services are typically provided online as part of a customer's sign-up process which they must agree to in order to continue the sign-up process (Linthicum, 2013).

2.4.7 DOS ATTACK

DoS attacks have the potential of leaving service users' accounts inaccessible. In a typical setting, DoS attacks are carried out by using botnet-triggered traffic to flood a website for legitimate users not to have access to it anymore (Wright, 2011). Wright mentioned that DoS attacks can be targeted at particular users by changing the users' account passwords or by entering wrong passwords continuously, which locks out the account and makes it difficult for the legitimate user to have access.

In April 2011, there was a report by the Hong Kong Government that Sony's payment gateway was hacked by attacks launched on their cloud computing servers (Hong Kong Government News, 2011). In this report, it was said that legitimate users were denied of their login rights and personal data of about 77 million customers were compromised, leaving about 11 million credit cards details open. This problem is similar to the issue of stolen personal information or in the case of materials prepared for exploitation (Cloud Security Alliance, 2010). According to Allen (2010), tracking down the offenders is usually hard in case of such incidence.

Allen (2010) mentioned an instance of DoS attack where terrorism funding was achieved with money laundered through the accounting system held in the cloud. Allen further explained that in the case of such event, legitimate users are faced with a negative consequence of not being able to access their data if the servers are seized by law enforcement agencies.

2.4.8 DATA ABUSE BY MALICIOUS INSIDER

Typically, abuse of data by malicious insider is triggered by employees, contractors or third-party suppliers within the service provider's organisation (Blumenthal, 2011). These individuals can misuse the privileges and rights given to them by their employer (CSP). They can disrupt the clients and have access to their data as well. People may become employed by a targeted CSP, targeted by organised crime syndicates, then start abusing their access following some kind of job dissatisfaction or temptation from potential opportunities or perceived gains (Blumenthal, 2011).

In their research (Aleem and Sprot, 2012), It was reported that 52.9% of ICT professionals who responded to their survey mentioned insider threats and attacks as a major issue with cloud computing adoption. In the event of such incident, clients' data are greatly affected.

Despite the extent of security and protection given to cloud computing, sometimes right and privileges given to employees can be of detriment to the company and its clients. For example, a former employee or contractor in a rival company can gain access to an organisation (where there is a poorly designed cloud computing system) by impersonating current employees (Blumenthal, 2011).

There are many reasons hindering the adoption of a new technology (Igbaria and Livari, 1995). In cloud computing, some of those reasons could be the complexity and resistance to the technology, understanding the technology, usage difficulty or even trusting the ability of the CSP (Adedoyin, 2013). Majority if not all of the issues discussed above are related to trust. Trust is a very important aspect of building and maintaining business relationships. In order to adopt cloud computing, SMEs need to have some level of trust in their service provider. Having trust in the service provider may help increase the adoption and usefulness of cloud computing services by SMEs. This will in turn enable them enjoy the benefits of the technology.

2.5 PREVIOUS STUDIES ON CHALLENGES OF CLOUD ADOPTION.

Below is a table summarising previous studies relating to the challenges of cloud computing adoption, their key findings and suggested solutions.

Author	**Research Area/Topic**	**Insight/Methods**	**Key Issues Identified**	**Findings/Suggestions**
Pearson and Benameur (2010)	Privacy, Security and Trust Issues arising from Cloud Computing.	These authors assessed how privacy, security and trust issues occur in cloud computing and discussed ways of addressing them. They focused on customers'	The key issues identified were grouped as follows: Privacy: Lack of user control, data proliferation and trans-border data flow and	This paper suggested that customers need to make sure that Service Level Agreements (SLAs) offered by CSPs capture 1. Data handling mechanisms (data protection and privacy law compliance,

		perspective with respect to data security, privacy and trust from public cloud computing.	unauthorised secondary usage. Security: Backup and lack of data availability, lack of data access, control over data life cycle, lack of standardisation, lack of multitenancy management and lack of proper auditing. Trust: Lack of customers' trust or weak trust relationship between the providers and their clients.	confidentiality, data location, and data retention and destruction policy). 2. Data security mitigation (e.g. encryption), Proper accountability Standardised solution e.g provision of trust assurance and audit frameworks for CSPs. CSPs need to safeguard the security and privacy of their customers' data to increase trust as well as the adoption of cloud systems by customers.
Zhao, et al. (2010)	Trusted Data Sharing over Untrusted Storage Providers	Their aim was to construct a system that imposes access control policies of data owners and prevents the CSPs from unauthorised access and illegal authorisation of access to customers' data.	Data integrity, confidentiality, security and unauthorised data access.	They proposed a progressive encryption scheme. They reported that this scheme allows data to be encrypted multiple times using different keys to produce a cyphertext that can be decrypted with a single decryption key. After performing what they called a comprehensive security analysis, the scheme showed that it can achieve trusted sharing of data over untrusted cloud servers. The scheme allows the encryption key to be changed without decrypting the data first. In other words, it allows data owners to store their encrypted data in the

				cloud and share with other users.
Khan and Malluhi (2010)	Establishing Trust in the Cloud.	Khan and Malluhi discussed how emerging technologies could help address the challenges in the cloud.	Data access control, security, privacy and data ownership.	These authors recommended the following: 1. Preventing failures than post-failure compensations. 2. The use of emerging technologies, which require identity theft management, data privacy via encryption, and using data integrity or security techniques (e.g. digital signature) to manage access control.
Uusitalo, et al. (2010)	The views of Security and User Experts in Cloud Services.	Uusitalo, et al. interviewed 33 people who demonstrated experience in the field of cloud computing. Out of these 33, 22 were from industrial companies while the rest were from research and governmental organisations.	Issues of security, privacy, transparency, reliability and availability of resources were identified.	Their findings revealed that issues of privacy and security (21%), transparency and reliability (30%), user experience (15%), availability of resources (9%) and language barrier are trust affectors.
KPMG (2010)	From Hype to Future. KPMG's 2010 Cloud Computing Survey. (Main Concerns regarding the use of Cloud Computing).	This survey consisted of 125 decision makers and business managers in Netherlands.	Security issues, privacy, compliance and legal issues were discussed.	The findings revealed that 78% of the participants considered security as a main concern, Legal issues (51%), Privacy issues (50%) and compliance issues (50%) were also identified. The participants were worried about lack of transparency in

				relation to service providers and 68% of them suggested that the aspect of data security should be improved.
Khorshed, et al. (2011)	Trust Issues that Create Threats for Cyber Attacks.	Khorshed, et al. surveyed the factors slowing down the adoption of cloud computing and reviewed the threats remediation challenges undertaken.	The following were the key issued discussed. Abuse and nefarious use of cloud computing, malicious insider, data loss and leakage, unknown risk profile and account, service and traffic hijacking.	These authors proposed what they called a proactive attack detection model using a machine learning language to 1. Detect any attack from the start to end. 2. Notify the customer of any attack by looking at the patterns of the attack in case the provider tries to hide the information from the customer. After a series of performances on popular learning techniques on their attack model, they revealed that their model proved efficient for its intended purpose.
Sultan (2011)	Reaching for the Cloud: How SMEs can manage	This article highlighted some advantages and challenges of cloud computing adoption by SMEs.	Data control, vendor lock-in, performance, reliability and privacy issues were discussed.	This article concentrated mainly on the advantages of using cloud computing. It suggested that as the technology matures, the challenges would be mitigated.
Cloud Industry Forum (2011)	Issues of Trust Affecting the Adoption of Cloud Computing by UK Businesses.	This involved a survey using 450 end user organisations in the UK.	Security, privacy, long term contract lock-in, confidentiality and vendor reliability issues were found as	Their findings showed that the following issues are threats to cloud service adoption: Security (64%), Privacy (62%), confidence in vendor

			trust barriers to cloud adoption.	reliability (38%), Contract lock-in (35%), Cost of change/migration (32%) and Contractual liability for service if SLA is missed (31%).
Ko, et al. (2011)	A framework for Accountability and Trust in the Cloud.	These authors investigated detective controls relating to cloud accountability and auditability, discussed key challenges using detective controls then developed a framework called "TrustCloud" to address accountability issues.	This study identified security, privacy, accountability and auditability as elements of trust.	Their conceptual model aimed at giving the cloud user a view of the CSP's accountability although, there was no empirical result of the model.
King and Raja (2012)	Promoting Distributed Accounting in the Cloud.	King and Raja proposed an information accountability framework to keep track of actual usage of customers' data in the cloud. They used programmable capabilities of Java JAR files to enclose logging mechanisms then provided auditing mechanisms to strengthen user control.	Issues of accountability, auditability, data control and unauthorised access were key issues discussed.	They explained that with their framework, any access to customer's data will trigger automated logging and authentication to the JARs.
KPMG (2013)	The Cloud Takes Shape. Global Cloud Survey: the implementation challenge.	A survey on cloud implementation challenge using more than 650 senior executives	This report discussed that challenges relating to privacy and security continues to appear	On a scale of 1 to 5 with 5 being the highest, risk of intellectual property ranked 4.21, data loss and privacy risks

		from multiple industries in 16 countries.	high for both IT and business executives.	ranked 4.19, general security risks ranked 4.11, and system availability and business continuity risks ranked 4.03. Majority of the respondents said they primarily rely on in-house resources than external providers or consultants, with a higher number from Asia Pacific region, Europe, Middle East and Africa.
Huang and Nicol (2013)	Trust Mechanisms for Cloud Computing.	Huang and Nicol surveyed existing mechanisms for establishing trust and commented on their limitations.	The following were key issues discussed: SLA verification, provider's reputation/trust, cloud transparency, formal accreditation, audit and standards.	By addressing the limitations, Huang and Nicol proposed a mechanism based on evidence attributes of the CSP (e.g. formal certification and validation). They suggested a framework which integrate the various trust mechanisms together to reveal the chains of trust in the cloud.
Cloud Industry Forum (2013)	UK Cloud Trend and the Rise of Hybrid IT.	This study involved a survey to determine the level of cloud computing adoption and to gain insights into attitudes, experiences and trends across UK end user communities. The survey participants consisted of 250 senior IT and business decision	Security, efficiency, data protection, privacy, contract lock-in issues were identified.	This study reported that efficiency issue (53%), security concerns (52%), and data protection issues (40%) are primary reasons affecting the adoption of cloud computing by business organisations. Also Data security (69%), privacy (51%), fear of loss of control/manageability (36%), Contract lock-in (28%), cost of migration (24%), and

		makers in large enterprises, small to medium businesses and public sector organisations.		confidence in vendor reliability (24%) were the most significant concerns affecting the decision making process of cloud computing adoption by business organisations.

Table 1: Summary of Previous Studies on Key Challenges to Cloud Computing Usage and Adoption, their Findings and Suggestions.

2.6 PREVIOUS STUDIES ON THE ADOPTION OF CLOUD COMPUTING BY SMES.

According to Sahandi, Alkhalil and Opara-Martins (2013), cloud computing plays an important role by addressing inefficiencies and making contributions to the competitiveness and growth of SMEs who adopt it. Being an affordable option, cloud computing creates effectiveness and efficiency, reduces cost of electricity, in-house staffing and operations and space and infrastructure (Susanto, et al., 2012). In addition to this, cloud computing customers only get charged for the computing resources they use based on their needs, since cloud services are given on-demand (Buyya, et al., 2008).

In spite of these benefits, in 2012, GoGrid (a datapipe company) mentioned that the adoption rate of cloud computing services by SMEs is slower than anticipated. In the past, studies have shown that the widespread adoption of cloud computing by SMEs is slow due to some influential factors (ENISA, 2009; Alshamaila and Papagiannidis, 2013; Sahandi, Alkhalil and Opara-Martins, 2012; Nussbaumer and Liu, 2013; Tehrani, 2013 etc.). In recent times, these issues are still prevalent (Abubarkar, Bass and Allison, 2014; Yeboah-Boateng and Essendoh, 2014); Ofili, 2015; Doherty, Carcary and Conway, 2015).

Lack of consumer trust is vivid in the 2009 International Data Corporation (IDC) survey. According to Bradshaw, et al. (2012), this survey showed that security and data location were of great concerns to UK businesses in relation to the adoption of cloud services. This was also supported by the result of their 2012 web-based interview of 1056 EU organizations (comprising of different sectors: Education, Healthcare, Government, Telecommunications, Finance and Manufacturing). In this survey, IDC asked respondents about a wide range of potential adoption concerns. In the order they were presented to the respondents, the restricting factors were security issues, data location, service support, inability to control changes made by providers, inability to evaluate cloud usefulness, lack of language version of the service, lack of a reliable internet connection etc.

Another issue faced by SMEs was revealed by the Fujitsu Research Institute survey conducted in 2010, to analyse current fears and concerns of SMEs on cloud services. Around the 3000 business owners interviewed in 6 countries, 88% were worried about who has access to their data while the other 12% were worried about confidentiality, location and privacy of their data. This was also supported by the result of the cloud computing survey carried out by Chung and Hermans (2010) to report on main concerns regarding the use of cloud computing. Out of the 125 decision makers and business managers interviewed, 55% of the participant organisations were yet to adopt cloud services because of concerns otherwise regarded as trust issues. While the remaining 45% using the service were worried about issues relating to data security, privacy, vendor lock-in and legal concerns.

While investigating the adoption process of cloud computing by SMEs in the North East of England, Alshamaila and Papagiannidis (2013) adopted the TOE framework as a theoretical base. These authors used a qualitative method by means of semi-structured interview to collect data from 15 SMEs and service providers from the North East of England. They found that the key determinants of cloud computing adoption are relative advantage, compatibility, company size, trialability and prior experience. However, this study found that competitive advantage was not a significant determinant of cloud computing adoption.

One major weakness of the qualitative method is that there are usually a small number of non-representative cases. In order to fully understand and generalise the adoption process of cloud computing by SMEs in North East of England, a more robust method involving larger representative sample should be used. Again, this study is only limited to using SMEs in the North East of England.

Gustafson and Orrgren (2012) conducted an interview using two cases (provider and user) to investigate the adoption process of cloud computing by SMEs. Using one user case and one provider case (both located in Gothenburg, Sweden), the results were grouped into two parts. The first part compared the user’s case to the provider’s case using integration and security, definitions by both the user and provider and their adoption decision process. The second part consisted of a process of describing the adoption of cloud computing. Findings from the first part revealed that both providers and users are striving for security, simplicity and movement of responsibility from the user. On the second part they found that the adoption of cloud computing is not as complex as perceived by many organisations and by moving hardware and applications out of the organisations, many users will be able to focus more on their core business strategies.

It is understandable that Gustafson and Orrgren were trying to be more focused using case study approach. Again, this cannot be generalised to all SMEs in study area as they have different requirements (depending on sector, company size etc.). The study results cannot also be generalised to all providers in the regions.

Gupta, Seetharaman and Raj (2013) investigated the factors influencing the usage and adoption of cloud computing services by SMEs. They collected data from 211 SMEs from various countries of the Asia Pacific region. Their data was analysed using SmartPLS and they found that convenience and ease of use were the top reasons behind cloud adoption. Secondly, for SMEs, improved security of the exiting cloud service solutions is a driving force that will make them more than willing to adopt cloud computing. It was reported that contrary to general belief, cost reduction is not among the top two reasons for cloud adoption.

This research is limited in the sense that it was only conducted in Malaysia, Singapore and India. This may not be representative of the SMEs in the whole of Asia Pacific region let alone the UK or the rest of the world. Also, they only studied five influential factors (ease of use and convenience, cost reduction, reliability, security and privacy and sharing and collaboration).

In 2013, Tehrani investigated the factors influencing the adoption of cloud computing by SMEs in North East of America (Tehrani, 2013). Using the DOI and TOE frameworks, this author developed a model. To empirically test the constructs of this model, Tehrani conducted an online survey involving 101 North East American SMEs. These SMEs were categorised into adopters and non-adopters. Findings from this study revealed that out of 8 factors investigated (relative advantage, external support, information intensity, decision makers' innovativeness, complexity, security, privacy and decision makers' knowledge), only decision makers' knowledge was found to have a significant influence on the adoption of cloud computing.

The major drawback of this study is that the sample size is limited in studying the adoption of cloud computing by the entire SMEs in the North East of America (as reported Tehrani). This may be the reason why only one factor out of eight proved to have a significant influence on the adoption of cloud computing. Secondly, the result of the study is only limited to SMEs located in the study area.

In order to study the institutional factors influencing the adoption of cloud computing by Indian SMEs, Bhat (2013) employed the Transaction Cost Economics Theory. According to Bhat, since IT usage by Indian SMEs has not been widely spread, this theory was employed to compare different dimensions of transaction cost of cloud computing (asset specificity, uncertainty, frequency) with factors influencing IT adoption by SMEs, in order to identify the institutional factors. The institutional factors identified were the cloud computing market, regulatory body which can regulate the service providers and enforce contracts, then an industrial body which can create awareness about cloud computing, promote its adoption and negotiate contracts with its providers.

The key weakness of this study is that it relied solely on literature. It would be worthwhile to empirically verify the various factors identified in the study.

In 2013, Carcary, Doherty and Conway carried out an exploratory study to investigate the issues relating to cloud service adoption by Irish SMEs (Carcary, Doherty and Conway, 2013). Using an online survey of 1500 SMEs with a usable response of 95, these authors found that 43% of the surveyed SMEs had already adopted cloud computing, with 70% of them being micro firms and 48% from knowledge intensive business sector.

Steps taken to adopt cloud computing by these adopters involved identifying services which were suitable for migration to the cloud, establishing the objectives and intention of moving toward cloud adoption and involving stakeholders in assessing their readiness to cloud adoption. Carcary, Doherty and Conway found that the major constrains for non-adopters were lack of awareness of cloud computing benefits, security issues, data ownership and protection concerns and lack of financial resources. They recommended the development of an SME-specific framework/model that emphasizes the preparatory steps, supports and guidance SMEs should take in order to efficiently migrate to the cloud. It was also suggested that this model should provide a strategy for selecting cloud service providers and how to manage relationship with them.

The major drawback of this work is that Carcary, Doherty and Conway (2013) only examined the preparatory steps for adoption and reasons for non-adoption. They didn't produce any guidance framework that highlights these preparatory steps to aid easy cloud computing migration of potential SME adopters. Although, this was recommended as part of future studies. Again, the sample was drawn from only three business sectors (Knowledge intensive business sector, services and manufacturing). Given that only 95 usable responses were retrieved from 1500 questionnaires sent out, this number is very limited to generalise their findings to the entire Irish SME community. As a result of this, these authors suggested that a larger sample should be used for a similar work, as their findings cannot be generalised.

Using the TOE and DOI theoretical frameworks, Amini (2014) developed a model to investigate the factors influencing the adoption of cloud services by Iranian SMEs. To test the model variables, Amini collected data from 22 SMEs who were customers of one provider. The data was collected using a questionnaire. The result of the data analysis using SmartPLS shows that compatibility, relative advantage, security concerns, technology readiness, competitive pressure and cost saving had significant influence on the adoption of cloud computing by Iranian SMEs.

The key problem of this study is that all 22 SMEs belonged to one provider. This means that they could share similar characteristics. The sample is also not considered big enough for generalisation. Again, this study is limited to Iranian SMEs.

In the course of exploring the issues affecting the adoption of cloud computing by SMEs in Sub-Saharan Africa, focusing in Nigeria, Abubakar, Bass and Allison (2014) adopted a qualitative strategy. They interviewed 10 SMEs from the ICT, manufacturing and finance business sectors. According to these authors, it was found that contrary to literature on issues to cloud adoption, the surveyed SMEs were less concerned about the challenges of cloud computing (security, data loss and privacy). Instead they were more optimistic towards adopting cloud computing for its potential benefits. It was also reported that since these SMEs were non-adopters of cloud computing, there was no proof to show that cloud computing can directly impact the development of the SMEs sector in terms of economic growth. This development can only be measured through the use of cloud computing by these SMEs. Top management support and awareness about cloud computing also proved to be determinants of adoption by these SMEs.

One major criticism of this work is that it was carried out using SMEs from three business sectors who were non-adopters of cloud computing but potential adopters. Again, Abubakar, Bass and Allison established that since cloud computing is yet to be a fully explored option in the Sub-Saharan Africa, there is limited literature regarding its adoption by SMEs in this area and as such the work cannot be generalised.

While researching into the adoption of cloud computing by SMEs in the UK, Sahandi, Alkhalil and Opara-Martins (2014) conducted a survey using 300 SMEs in the UK. In this survey, they explored SMEs requirements, motivations and concerns with respect to cloud computing adoption. Using a sample of 300 SMEs in the UK, a total of 169 usable responses were retrieved. These responses were dominated by SMEs having between 51 to 250 employees. From their data analysis, they found that cost reduction (45.5%), convenience in accessing applications (44.9%), ubiquity and flexibility (38.9%), increased computer capacity (32.9%) and greater IT efficiency (31.7%) were key motivators of cloud adoption by these SMEs.

In terms of SMEs requirements for cloud adoption, it was reported that many SMEs (32.5%) plan to use cloud computing for current business operations, 27% of the SMEs had no plan in place for using cloud services, 20.2% said they didn't know if they would use cloud services, 17.8% planned to use cloud computing for new business operations while the remaining 25% indicated others. Additionally, hosting services, backup services, hosted emails and data storage were found to be services most likely to be outsourced to cloud computing. On the other hand, issues of privacy, data protection and vendor lock-in were reported as top reasons for not considering cloud computing adoption.

A serious weakness of this study is that the sample was biased in the sense that it was dominated by medium sized companies. As a result, findings may not be generalised to micro and small companies.

In 2015, Carcary, Doherty and Conway investigated the drivers and barriers to cloud computing adoption by Irish SMEs. Using an online survey of 1500 SMEs in Ireland, with 95 usable responses, these authors found that SMEs in Ireland were adopting cloud computing because of cost benefits. However, concerns about service availability was identified as a key challenge to the widespread adoption of cloud computing by Irish SMEs. As evident from their 2013 work, these authors used the same sample of 1500 with again only 95 usable responses. Result of this study cannot be generalised to the entire Irish SME community. As a result, they suggested that a larger sample should be used for similar work since their findings are not generalisable.

From the studies reviewed so far, it can be concluded that the perceptions of SMEs in different geographical locations are different in terms of cloud computing adoption. They have different needs and requirements. For example, businesses in Europe have different behaviours compared to their Asian or American counterparts. The study carried out by Tata Consulting

Services, India, reported that Europe and USA lag behind the rest of the world in terms of cloud computing adoption (Forbes.com, 2012).

Again, following the launching of an on-demand, internet-based business software platform for SMEs by Tata Consulting Services and Microsoft, with IBM claiming that its new product will fuel the full-scale adoption of cloud computing, the widespread adoption of cloud computing has still not been achieved (Tyler and Hurley, 2011). Tyler and Hurley revealed that the UK appears to lag behind the rest of Europe with respect to the cloud computing survey of 1600 companies by the virtualisation company VMware. This study reported that only 48% of SMEs in the UK had adopted cloud computing compared to an average 60% of SMEs across Europe.

2.7 CHAPTER SUMMARY

In this chapter, the general concept of cloud computing as well as its definition were given. A review of all the benefits and challenges were presented. Further to these, the chapter provided a summary table consisting of previous studies on the challenges of cloud computing. This was followed by a review of those that studied the influential factors of cloud computing adoption by SMEs. This chapter was written to explore the research area in a broader context and to identify a gap in knowledge. Since the entire review in this section was related to cloud computing concept, the next chapter will explore the concept of trust and how it relates to this research.

CHAPTER 3

THE CONCEPT OF TRUST AND ITS OPERATIONALISATIONS IN THIS RESEARCH

This chapter introduced the concept of trust and its operationalization in this research. It discussed different views of trust and different definitions of trust. It also discussed trust in relation to online transactions and technology acceptance. It reviewed the studies highlighting trust issues. Trust was also discussed as an independent element from security and privacy (in the cloud computing perspective). A review of trust related models was given followed by full details of the model selected for the study together with its justifications.

3.1 INTRODUCTION

Trust is a concept with many dimensions which have been studied in many disciplines (Kumaraguru, et al., 2006). For example, in economics, trust can be established through an agent's reputation and their effect on transactions (Cave, 2005); in marketing the focus of trust is on strategies for customers' persuasion and trust building (Chellapa and Sin, 2005); in human computer interaction, trust is the relationship between a system design and its usability (Reigelsbergal, et al., 2005). Whereas in psychology, trust has been studied as a group and interpersonal phenomenon (Salovy and Rothman, 2003). Traditionally, in the marketing literature trust is studied in terms of both the salesperson and the seller organisation (Morgan and Hunt, 1994). For example, when the salesperson is peripheral or absent in the buying and selling process (e.g the case of Internet stores), then the main focus of the consumer's trust is the seller organisation (Chow and Holden, 1997).

According to Morgan and Hunt (1994), trust develops when a trustor has confidence in the reliability and integrity of the trustee. In his book (Nooteboom, 2007), trust was defined as an expectation that a partner will not engage in opportunistic behavior, for whatever reason, including the control of his conduct, the absence of control of his conduct or even in the face of short-term opportunities and incentives. Trust has been discussed in other studies (Cao, Zhang and Seydel, 2005; Langfield-Smith and Smith, 2003) as a crucial component in outsourcing relationships.

"Trust is a belief, attitude, or expectation concerning the likelihood that the actions or outcomes of another individual, group or organisation will be acceptable or will serve the actors interests" (Sitkin and Roth, 1993). Sirdeshmuk, Singh and Saboh (2002) defines trust as customers' expectation that the service provider is dependable and reliable to deliver on his or her own premise.

In addition, trust may be based on a trustor's evaluation of trustee's ability, integrity and benevolence or usually a combination of the three dimensions (Mayer, Davis and Schoorman, 1995). In different situations trust is likely to differ in terms of ability, integrity and benevolence (Kramer, 1996). In some situations, trust may be about ability and in other it may be about integrity or benevolence. In any situation, it usually starts with the development of an initial trust (otherwise known as a 'Leap of Faith' by Mollering, 2007) leap of faith). As explained by McKnight and Chervany (2006), initial trust refers to the initial stages of building a relationship where the parties have little or no experience with one another. Interestingly, initial trust is very important because establishing a first or long-term relationship always starts with an initial trust (Johasen, Selart and Gronhaug, 2013).

According to Vlaar, Van den Bosch and Volberda (2013), initial trust tends to shape subsequent communications and interactions through its effects on expectations. Meanwhile Saunders and Ahuja (2006) revealed that situations warranting initial trust where people meet with new and unknown individuals have become prevalent. This is as result of increased reliance on temporary work groups, increased use of external consultants (McKenna, 2006) and restructuring (Falkenberg, et al., 2005). Although, some of the relationships never extend beyond a short-term relationship (McKnight and Chervany, 2006).

According to Lewicki and Bunker (1996), people do not totally commit themselves to a relationship but gradually this total commitment comes through their experiences with the trustee (Kin and Koo, 2016). Again risk and dependence are often established in such situation regardless of the trustor's choices. In this regard, Selart (2010) explained that oftentimes people find themselves depending on those they may not even know and their knowledge about that relationship is likely to be influenced by their initial interaction.

Even though risk is not being extensively discussed in the trust literature, Johasen, Selart and Gronhaug (2013) explained that building an initial trust is associated with having small to moderate risk. They also explained that every relationship starts with small to moderate level of risk which results from people's discretionary choices. Risk is thus defined as "the extent at which there is uncertainty about whether potentially significant and/or disappointing decision outcomes will be realized" (Kin and Koo, 2016; Silkin and Pablo, 1992). As explained by Silkin and Pablo (1992), risk is associated with three dimensions which are knowledge about the distribution of potential outcomes, uncertainty or variability of the outcomes and the uncontrollability of the potentials of the outcome.

While the work of Hawes, Mast and Swan (1989) suggested that trust is based on perceptions, McAllister (1995) revealed that trust and risk are connected. Meanwhile Bradach and Eccles (1989) explained that for there to be the need to trust, then some level of risks is unavoidable. Additionally, trust is seen as an "expectation that an exchange partner will not engage in an opportunistic behaviour" (Bradach and Eccles, 1989). However, one consequence of trust is that it minimizes the customer's perception of the risk associated with the seller's opportunistic behaviour (Mayer, Davis and Schoorman, 1995).

In the cloud computing context, very little has been written in relation to trust-risk perception. Since cloud computing is an online marketplace providing large volume of data in terms of user and trade volumes (Hong and Cho, 2011), Pavlou and Gefen (2004) explained that it is associated with different risk factors.

In their works (Gefen and Pavlou, 2012; Kim, et al., 2008), it was reported that trust and risk are the two most critical factors affecting the decision-making of buyers in an online marketplace. In this regard, a number of empirical studies have demonstrated the direct influence of trust and risk in transaction activities (e.g. Lee and Song, 2013; Johasen, Selart and Gronhaug, 2013; Verhagen, Meents and Tan, 2006; Kim and Koo, 2016).

According to Uusitalo, et al. (2012, there is no general definition of trust. Most definitions of trust in existence today are discipline-specific. Different perspectives of trust have been widely discussed, with a good number of studies done by proposing a model to explain the concept of trust in the different contexts.

3.2 TRUST IN ONLINE TRANSACTIONS

According to Kumaraguru, et al. (2006), trust is an important component for online transactions and internet users do not know whether to entrust their personal information to an online merchant. As a result, it has become increasingly difficult to make good online trust decisions. As explained by Xin and Datta (2010), trust plays an important role in promoting cooperation in many decentralised settings (e.g ecommerce or internet). Trust is an estimation of competence of a resource provider in completing a task based on reliability, security, capability and availability in the context of distributed environments (Sangeeta and Patra, 2013).

Having cloud computing as a part of online transactions, the ability of dealing with uncertainty and proper risk assessment is required before any adoption decision can be made. Survey participants always mention lack of trust as a reason for not doing online transactions and in the case of cloud computing, a reason for non-adoption (see Pearson and Benameaur, 2010; Ko, et al., 2011 etc.).

Cloud computing transactions often involve entities or people who barely know themselves and sometimes parties that have never met. In such circumstance, failure to carry out transactions with due diligence could result in serious consequences (Adjei, 2015). The expectations of parties to act and react willingly makes trust a very topical concept in the discussions of cloud computing. Nevertheless, to better understand the role of trust in the discussions of cloud computing, certain attributes must be understood.

According to Adjei (2015), trust by nature, is not distributive (cannot be shared), neither is it transitive (not passed from one person to another) nor associative (linked to another trust or added together). Adjei also explained that trust is also not symmetrical, in the sense that ' I trust you' does not mean that 'you trust me', and trust cannot also be self-declared. This is because when people say 'trust me', the question that follows is ‘why?’ According to Slone (2004), trust is defined as a firm belief in honesty, reliability, good faith, veracity, in the intent of another individual/party to conduct a transaction, contract, deal, pledge etc. in accordance with the agreed rules and expectations.

Since trust is an important factor for cloud computing adoption (see Pearson and Benameur, 2010), there is need to provide a solution to tackle it. A common approach to be adopted for this research is based on Mayer, et al. (1995) which sees the trustor as considering engaging in an online transaction with the trustee. Several researchers have mentioned factors of trust between the trustor and the trustee which they refer to as antecedent of trust (Kumaraguru, et al., 2006).

While Mayer, et al. (1995) identified the trustee’s perceived ability, integrity and benevolence as antecedents of trust, others focused on

- Comprehensive information, shared value and communication (Lee, et al., 2000).
- Disposition of trust information from others, prior knowledge or experience, trustees’ reputation and trust on the information technology (Egger, 2003).

Ang, et al. (2001) proposed that trust arises from the trustee's ability to deliver on its promises, his willingness to rectify any problems arising from dissatisfaction, and his respect towards the personal privacy of the trustor.

3.3 TRUST IN TECHNOLOGY ACCEPTANCE

It is very important to relate trust to technology acceptance. As explained in Pearson and Benameur (2010), there are different ways of establishing an online/technological trust. Security is seen to be one. Although, Osterwalder (2001) argued that security does not imply trust. Also, Nissenbaum (1999) mentioned that the level of security does not affect trust. On the contrary, Giff (2000) revealed that to increase security is to increase trust and an example of such comes from the willingness of people to engage in e-commerce knowing that their credit card numbers and personal data are cryptographically protected.

With respect to cloud computing, trust is very important especially when it relates to the service providers and their clients. Sun, et al. (2011) revealed that the integrity, ability or competency of the service providers are carefully considered in building trust relationships which involve sensitive data. In addition, Reputation (a company's most valuable asset) appears to be another way of building trust (Nissenbaum, 1999). Through reputation or brand image, an online trust can be developed and suffers if there is a breach of trust, security or privacy (Pearson and Benameur, 2010). Trust is hard to build but very easy to lose. "A single violation of trust can destroy years of slowly accumulated credibility" (Nielsen, 1999).

3.4 RESEARCH HIGHLIGHTING TRUST ISSUES

Trust revolves round the assurance and confidence that people, data, information, entities or processes will function or behave in an expected way (Robinson, et al., 2011). Establishing trust for resource sharing and collaboration has become a significant issue in the distributed computing environment (Abawajy, 2011). The term trust in the cloud computing context has been used as a general term to refer to privacy, security, confidentiality and accountability (Huang and Nicol, 2013).

Trust is a significant factor in cloud computing which depends largely on the perception of reputation and self-assessment of the service providers (Huang and Nicol, 2013). This is because the reputation of cloud providers is very useful for users when choosing a service provider and will undoubtedly impact the user's choice of a particular cloud service. Reputation also helps to enhance trustworthy collaboration between the service providers and their client.

When it comes to the implementation of cloud computing, UK SMEs are hesitant about entrusting their valuable information to a CSP thus making the adoption of cloud computing very patchy (Condon, 2013). In order to promote consumer confidence in cloud computing service and potentially promote greater adoption of the technology, the security issues or challenges of cloud computing must be addressed (Brodkin, 2009). This will help achieve the public embracement of the technology in due time. However, security concerns alone might not be the only factors influencing the adoption of cloud computing services. There is need for assurance that providers are willing to follow sound practices relating to mitigating the risks faced by their customers.

Research in this area explain issues relating to security, privacy, confidentiality and accountability by framing them as trust issues. As can be seen below, there are many trust related issues hindering the adoption of cloud computing. Habib, Ries and Muhlhauser (2010) highlighted issues of service selection, assurance level of cloud services and trust establishment as top problems facing the cloud environment. With respect to establishing trust in the cloud, Khan and Malluhi (2010) provided an overview on the important aspects of trust that need to be considered when choosing a service provider. Accordingly, the following issues were identified:

- Lack of trust
- Lack of identity management solutions for federated clouds
- Lack of confidentiality
- Weak Service Level Agreements (SLAs).
- Lack of Standards
- Lack of Interoperability
- Lack of customer support
- Lack of reliability
- Lack of Independent Quality Assurance Body.

Khan and Malluhi opined that to address these problems, there is a need to reliably identify and standardise the quality of service provided by cloud providers. This will also increase customers' confidence in taking up cloud service as well as in selecting the right service provider. This paper also suggested that the reputation level applied in the area of ecommerce, should also apply to the cloud network. Khan and Malluhi came up with what they considered state-of-the-art trust and reputation model, a new research direction that uses trust and reputation concepts to help customers select service providers. In their proposed model, the need to identify relevant parameters for customers as a basis for trust establishment was addressed. Even though their model seemed promising in helping customers (in areas such as selecting service providers), they did not address most research challenges (such as attacking resistance, making trust information transparent to users, transferring trust between contexts etc.).

Pearson and Benameur (2010) carried out a research that focused on trust issues arising from public cloud computing. These authors highlighted the following problems as top trust issues in the public cloud computing environment:

- Weak trust relationship between the users and CSP.
- Lack of user's control over data deletion.
- Trusting the contracted third party.
- Lack of standardisation
- Improper auditing
- Unrestricted access to user's data

Pearson and Benameur suggested that these problems could be addressed through data security mitigation, design for privacy, standardisation, accountability and data handling mechanism. These involve an organization classifying its information assets to clarify the confidential data before selecting a CSP. Such organization should make sure that such aspects of interest to them are stated clearly before negotiating agreement. Pearson and Benameur added that one way to build customers' trust for a CSP is to have appropriate governance framework in place to assure customers that the CSP will fulfil the promises written in their terms of service. This goal can be achieved by having the CSP certified against Information Technology Infrastructure Library (ITIL), Control Objectives for Information and Related Technologies (COBIT) etc. These authors suggested that this is just an initial step in building the trust relationship but more mechanisms need to be in place to enable data rights management.

Having discussed the above issues, Pearson and Benameur (2010) mentioned that since legal frameworks and legislations are essential to the protection of user's personal and sensitive information, their validity and implementation should still apply to cloud computing. In addition, such framework with its associated tools, advice and national legislation should constantly be updated. However, these were suggestions and there was no concrete discussion relating to the practicality of the solutions proposed.

Uusitalo, Karppinen and Savola (2010) conducted a survey on the views of security, user experience and experts view on trust in cloud services. 33 persons who demonstrated experience in this field were interviewed and the result showed that the factors affecting trust in cloud services are brand, security, privacy, transparency and reliability. This paper only highlighted main observations from an interview study on experts' views on trust in cloud services, there was no other recommendations or suggestions made to provide solutions to these problems.

In determining the trust issues affecting the adoption of cloud services by UK businesses, Cloud Industry Forum carried out a survey in 2011 (Cloud Industry Forum, 2011). The 450 end user organizations interviewed comprised of those making use of cloud services and those that would do so in the future. The result showed that long-term contract lock-in, weak service level agreement (SLAs), confidentiality, accountability and transparency were the major challenges hindering the adoption of cloud services by these organizations. This was supported by the result of the 2012 web-based interview of 1056 EU organizations carried by Bradshaw, et al. (2012), to rate the challenges of cloud adoption by SMEs.

According to Durkee (2010), inappropriate Service Level Agreements (SLAs) is a factor affecting trust relationship between the CSPs and their customers. Because many of the current cloud customers use price as a decision criterion in selecting CSPs, CSPs' offerings tend towards the lowest common denominator thus providing inappropriate SLAs. Durkee (2010) suggested that cloud providers must negotiate with their customers to deliver their services to suit customers' needs then provide details regarding the inner workings of their cloud architecture, as a way of developing closer relationship. Although, no further discussion on how these suggestions could be made or were made practical was provided.

Another trust issue faced by SMEs was revealed by the Fujitsu Research Institute survey conducted in 2010 to analyse current fears and concerns of SMEs on cloud services (Ko, et al., 2011). In this research, around 3000 business owners were interviewed in 6 countries. Accordingly, the respondents provided answers to the following questions:

- Do you want to be asked to give permission for your data to be shared? Here, 90% of American customers and 77% of Japanese indicated yes.
- What is your concern about access to your personal data? In this regard, 88% were worried about who has access to their data while 84% were worried about where their data is stored.

- Do you worry about unrestricted access to your data by the government? In this context, 70% of German customers and 46% of the American customers expected the Government to keep out of their personal data.
- What is your opinion about the benefits and risks of online shopping? In this question, 36% of Singapore customers believe that the benefits of creating personalised data when shopping online outweighs the risk while 17% of UK customers indicated the same.

If not for anything else, figures in the first three questions estimate people's fears on the access and confidentiality of their personal data. 80% of the respondents expected that there should be some policies guiding the use of data, which should be implemented. This belief is however undermined by the lack of trust in the competence of both the Government and service providers. Ko, et al. suggested that the Government and service providers have some roles to play here. In addition, many of the respondents believed more on the risks involved in creating personalised data when shopping online than the benefits.

The cloud computing survey carried out by Chung and Hermans (2010) reported on the main concerns regarding the use of cloud computing services. Out of the 125 decision makers and business managers interviewed, 76% considered security issues to be the main concern. Additionally, legal (51%), privacy (50%) and compliance (50%) issues were considered to be areas leading to distrust on the use of cloud services. As reported by Chung and Hermans, the respondents were less worried about lack of security measures compared to lack of transparency on the side of the service providers which was a major concern. 68% of the respondents suggested that the aspect of security in their data should be improved.

King and Raja (2012) showed that the line between sensitive data and other forms of personal data is not clear in Europe (Europe) and the United States (US) regulatory frameworks, thus leaving much room for debates about providing businesses with data protection in the cloud. This according to King and Raja leads to a breach of trust. These authors suggested that proper guidelines should be provided on what law exists in Europe and America with respect to protecting customers' data in the cloud. And these laws should be revised to avoid jeopardizing trust in cloud services.

Even though King and Raja presented what they regarded as one of the approaches to secure sensitive customer data in the cloud, their method of enforcing regulatory reforms is not the only way to protect customer's sensitive data in the cloud. Although, according to them this is beneficial to both the customers and service providers. Secondly, the fact that they made suggestions for regulatory reforms that will protect sensitive information in the cloud environment, and the removal of regulatory constraints that currently limit EU and U.S businesses from taking full advantage of the cloud benefits, is not enough to say that this will totally increase customers' confidence on cloud their providers. Moreover, this study is limited to the EU and U.S only.

With respect to accountability and auditability in the cloud, Ko, et al. (2011) discussed detective controls then identified the following as top threats in cloud computing:

- Abuse and misuse of cloud computing
- Insecure application and program interfaces
- Untrusted insiders/employees
- Unprotected Shared technology
- Loss or leakage of data
- Service, traffic and account hijacking

Ko, et al. proposed a model of accountability and trust in the cloud. The result of their study showed that accountability is achievable. Even though they argued that their conceptual model can be potentially used to give cloud users a view for accountability of the CSP, accountability is not the only method of increasing customers' confidence on their service providers. Their work focused more on the detective measures and not the combination of both the detective and preventive measures.

Further research by Zhao, et al. (2010) suggested that there are trust issues between services users and their providers. These authors proposed what they called a progressive encryption scheme to promote trusted data sharing over untrusted cloud providers. This model was designed to allow data to be encrypted multiple times and changing the encryption key without decrypting the data first. Their result suggested that this model mandatorily enforces sharing policies specified by a data owner thereby preventing cloud providers from unauthorised access.

Another trust issue was revealed following the report from the formal National Security Agency (NSA) contractor Edward Snowden. As stated in The Guardian Report of June 2013, from the wake of Snowden's revelations, people around the world now doubt the security and privacy of their communication flowing through the servers of American Companies (Eoyang and Bishai, 2015). Snowden alleged that the NSA was collecting the telephone records of millions of people in America by tapping directly into the servers of many internet firms (e.g Google, Yahoo, Microsoft and Facebook) and that the NSA accessed many American companies' data without their knowledge (Poitras, et al., 3013). According to the report releaseed by the American Office of the Director of National Intelligence in July 2013, these data accessed by the NSA may not have any direct significance to the core security concerns or foreign policies of the United States (DNI, 2013). The technology companies who were victims of this NSA activities reacted with outraged media reports that the NSA intruded into their networks overseas and spoofed their products or webpages without their knowledge (Gellman and Soltani, 2013). According to Timberg (2014), this story suggests that the government created and sneaked through back doors to access the data instead of doing that legitimately.

Again documents leaked to the Washington Post in mid-August 2013, suggested that the NSA breaks USA privacy laws hundreds of times in one year (BBC News, 17th January, 2014). As a result of this, many US based companies shifted to an adversarial relationship with their government, then moved to encrypt and secure their customers data (BBC Technology, 19th November, 2013). These companies are now building state-of-the-art datacenters in Europe, pushing for reforms, challenging the government in court and employing Europeans for their high-paying job roles (Miller, 2014; McDougall, 2015).

Secondly, US international technology and communications companies' customers started taking their businesses to somewhere else. For example, Brazil decided against Boeing deal of $4.5billion then cancelled Microsoft contacts (Miller, 2014). Germany stopped using Verizon in favour of Deutsche Telekom (Hudson, 2014). These suggests that even friendly governments can easily decide to drop big companies and corporate customers then switch their data providers for greater security and privacy protections.

According to Aberer, et al. (2012), the issues of privacy, trust and reputation still exist in the cloud computing industry and as a result, there is a great demand for research to be done on this area. This view was also supported by the works of Almutairi, et al. (2012) and Ren, Wang and Wang (2012). Since customers lack control of cloud resources, they are not in a good position to utilise technical mechanisms in order to protect their data against unauthorized access, secondary usage or other forms of misuse. Therefore, they must rely on contracts with providers or other trust mechanisms to try to encourage appropriate usage.

Previous studies have shown that at the core of building a relationship, there is a need for building trust. According to Doney and Cannon (1997), trust develops when a buyer sees the firm or salesperson as honest, reliable, trustworthy and consistent. It was also revealed that trust and relationship development are important components in building business relationships between customers and firms. In addition, building cooperative relationship is important to marketing success. Morgan and Hunt (1994) also explained that a firm builds commitment and trust by the provision of superior benefits, keeping high standards corporate values, communicating valuable information and avoiding taking advantage of their clients/ customers.

As discussed in the sections above, the adoption of cloud computing by SMEs is still slow compared to their larger counterparts. Reasons for this slow rate of adoption are attributed to some challenges and majority of the challenges relate to issues with the service providers. As discussed above, these issues could affect the trust that their clients have in them. In order to better explain the concept of trust in cloud computing using a theoretical model, several trust models were reviewed. These models have been discussed below.

3.5 TRUST AS AN INDEPENDENT ELEMENT FROM SECURITY AND PRIVACY (CLOUD COMPUTING PERSPECTIVE)

In the cloud computing literature, there has been a lot of studies on the security and privacy of users' data in the cloud, from the technical perspectives. However, there is not much work done to examine how cloud computing users come to trust their service providers in securing their data. To understand the concept of trust outside the perspectives of security and privacy in cloud computing, it would be better to define the terms as their usage may change depending on the contexts which they have been applied.

According to Robinson, et al. (2010), security relates to confidentiality, availability and integrity of data. It may also include authentication and non-repudiation. Privacy concerns the expression of or adherence to various legal and non-legal norms regarding the right to private life. In the European context, privacy is often understood to be compliance with data protection regulations (Pearson and Benameur, 2010). In the cloud computing context, it would be highly useful to map cloud issues into the full panoply of privacy and personal data protection regulatory architecture. The globally accepted privacy principles give a useful frame: consent, purpose restriction, transparency, data security, legitimacy and data subject participation (Robinson, et al., 2010).

On the other hand, trust means an act of faith; confidence and reliance in something that's expected to behave or deliver as promised. It is a belief in the competence and expertise of others, such that you feel you can reasonably rely on them to care for your valuable assets (Khan and Malluhi, 2010).

According to Sun, et al. (2011), trust is strongly tied to security, usability, privacy, reliability, availability, confidentiality etc. Hoffman, et al. (2006) explained that a comprehensive trust model must predict how usability, reliability, privacy, and availability (and possibly other factors), as well as security, affect user trust. Trust may be human to human (as used in this research), machine to machine (e.g. handshake protocols negotiated within certain protocols), human to machine (e.g. when a consumer reviews a digital signature advisory notice on a website) or machine to human (e.g. when a system relies on user input and instructions without extensive verification) (Robinson, et al., 2010). At a deeper level, trust might be regarded as a consequence of progress towards security or privacy objectives (Khan and Malluhi, 2010; Pearson and Benameur, 2010 and Robinson, et al., 2010). Security plays a central role in preventing service failures and cultivating trust in cloud computing.

According to Sun, et al. (2011), the attributes of security (e.g. data access control, data integrity, authentication etc.) and privacy (e.g. data confidentiality, user anonymity) are elements of trust. Trust is established depending on how these attributes are managed.

The issue of trust is one of the biggest obstacles for cloud computing development (Tian, Lin and Ni, 2010). In the cloud computing context, trust cannot be fully described without including the attributes of security and privacy. For example, because users lack full controllability of data and equipment, which are placed in the providers trusteeship, any violation of security procedures many lead to data loss, service interruptions or security risks, which may in turn lead to trust issues. Also, if the CSPs reputation is poor, it may lead to a low level of trust.

It is important that the user trusts the cloud servicer provider to continue to use their services. However, it is most important for the provider to provide proper security and privacy measures to secure the customers' data in the cloud. This will ensure that trust continues. Conversely, a breach of security may introduce risk and lack of trust on a service provider or the technology.

The main focus of this study is on trust. However, the issues of security, privacy, confidentiality, availability of service, reliability of service provider etc., have all been treated as elements of trust.

3.6 A REVIEW OF TRUST RELATED MODELS

Bstieler (2006) investigated trust formation in collaborative new product development. This author investigated both the antecedents of trust formation in interorganisational partnerships and the effect of trust on the performance of these partnerships. The interorganisational relationship investigated in this regard was focused on vertical partnership, which comprises of interim and collaborative working relationships between the manufacturers, suppliers and customers. The main focus of this study was conception, testing, production and marketing of a new product.

Bstieler proposed that shared problem-solving facilitates communication which generates an experience of shared instruction and learning, and provides feedback regarding the skills of the partner, all of which promotes trust. Accurate, open, adequate and timely communication promotes trust through the development of shared understanding. Fairness is the application of procedural and distributive justice throughout the relationship. Conflict on the other hand, can develop if there is no shared understanding and this can increase tension. With egoism trust can be undermined because it represents self-interested behaviours. Thus both conflict and egoism were proposed to reduce the level of trust. Bstieler also argued that performance is not directly impacted by communication and other variables of interest instead, these variables impact the level of trust which in turn affect performance.

Bstieler developed a model in which trust was conceptualised as an outcome of three promoting factors (Shared Problem-solving, Communication and Fairness) and two inhibiting factors (Conflict and Egoism). To test this model, data was collected for 44 new products developed through the partnership of 34 manufacturers. Trust was measured using questions related to frankness, keeping promises and honesty. Using hierarchical multiple regression, this study reports that relationship experience was significantly associated with trust information but the type of product newness or partnership showed no relationship with trust. One weakness of this model (developing trust in this type of interorganisational partnership) is that trust needs to be given balance in terms of maintaining proprietary interests, if balance if not maintained the partnership is likely to fail.

Cote and Latham (2006) investigated the relationship between trust and commitment as intangible drivers of organisational performance. This study focused on the aspects of finance within an organization that the management uses to reach a decision. Cote and Latham argued that traditional influences such as trust and commitment have not been given much emphasis as drivers of performance. These authors developed a model of trust and commitments within an interganisational setting. This model suggests how formal and informal interorganisational relationship structures influence trust and commitment, which in turn promote performance outcomes.

According to Cote and Latham, this model addressed the antecedents and outcomes of trust and commitment within an organizational setting. Their goal was to bring issues regarding trust and commitment into greater attention, then develop a causal model that would be very useful in that regard.

This model identified six antecedent of trust variables (legal bond, termination cost, shared values, benefits, opportunistic behaviour and communication). The outcomes were financial performance, functional conflict, cooperation, acquiescence, propensity to leave relationship and decision making uncertainty. Most of the variables were either tied to trust or commitments but shared values were tied to both trust and relationship commitment. Financial performance and cooperation were also linked to both trust and commitment.

The validity of the model was explored in a healthcare setting, which was seen by Cote and Latham as an ideal context to test the model empirically. Data was collected from 166 staff and physician practice managers using 29 data collection sites. The participants included those who regularly interact with insurance companies while at work. Their findings suggested that commitment to the interorganisational relationship was increased when partners had a higher degree of trust and relationship benefits. Interorganisational partners who had appropriate degree of communication (both formal and informal) had greater trust. However, shared values was found to have no significant influence on trust or relationship commitment. Cote and Latham also reported the significant positive influence of trust and commitments on financial outcomes.

From the perspective of the researchers, the critical finding of their research is that when two or more organisations are required to work together, factors such as trust and commitments can have a strong impact on performance outcomes. But if problems are identified early enough, then efforts can be made to focus towards improving trust and commitments in order to ultimately improve the organisation’s performance.

Dirks, Lewicki and Zaheer (2009) investigated the ways in which interorganisational relationships can be repaired following damage. This work defined relationship repair as existing when a transgression causes the positive states that make up the relationship to disappear and the negative states to arise, as perceived by one or both parties, and the activities by one or both parties significantly return the relationship to a positive state. According to Dirks, Lewicki and Zaheer, they examined many different but interacting aspects of relationship but their main goal was to determine which underlying structure of a relationship is damaged by transgression, and thus needs to be repaired. They argued that when transgressions occur in a relationship, three major factors are likely to be impacted. These are negative effects (which intensifies), trust levels (which diminishes) and subsequent changes in the nature of exchanges (for example, suspension of positive exchange and/or initiation of negative exchanges (eg. revenge or retribution)). A conceptual map was developed by Dirks, Lewicki and Zaheer to represent the three factors. These authors argued that there are several studies which explored two of the three factors but none has explored all three.

3.6.1 THE INTEGRATIVE MODEL OF ORGANISATIONAL TRUST (IMOT)

Due to the much interest generated on the concept of trust at the organisational level, Mayer, Davis and Schoorman developed the IMOT model in 1995 (Mayer, Davis and Schoorman, 1995). The IMOT explains the nature, causes and effects of trust at the organiosational level. Mayer, Davis and Schoorman considered the characteristics of the trustor, trustee and the risk involved in building trust as prior approaches to studying trust at the organisational level. They also presented a definition of trust, its outcomes and a model of its antecedents by considering research from various disciplines. In this model, ability, benevolence and integrity were presented as antecedents of trust (or factors of perceived trustworthiness).

This model explains trust from one individual to another by considering both the trusting party and the party to be trusted. Since people depend on others to accomplish their individual or organisational tasks, this model (as explained by Mayer et al., 1995) focuses on trust at the organisational level; which involves two parties (the trustor and the trustee). The trustor is the trusting party while the trustee is the party to be trusted (Mayer, Davis and Schoorman, 1995; 2007).

Mayer, Davis and Schoorman (1995) discussed the trust concept by relating it to different bodies of literature, which include management, psychology, philosophy and economics. They found out that scholars of these disciplines explained trust to suit their various disciplines even though a good number of them gave insightful views and perspectives that past one another.

Mayer, Davis and Schoorman integrated these views and perspectives of trust into a single model to explain the concept of trust. Their initial intention was to provide a model, which would be applicable to different disciplines. After a series of reviews, these authors found out that their initial intention was not fully achieved. As a result, they provided an extended version of their initial model of trust showing some clarifications and definitions of trust. They argued that trust was as an aspect of a relationship and should be seen in the following ways termed 'trustworthiness dimensions':

- Trust in ability
- Trust in integrity
- Trust in benevolence

In this regard, trust in ability explains the fact that an individual could perform and therefore be trusted; trust in integrity is the perception that the individual will fulfil all agreements as promised; while that of benevolence explains the extent to which an individual will want to do good for the trusting party without an egocentric intention. Their view of trust with respect to ability and integrity seems to be well accepted compared to that of trust in benevolence. Although, they explained that these three factors contribute to trust in a group or organisations. In summary, their model was designed considering the factors that explain trust at both the individual level and that of the organisation.

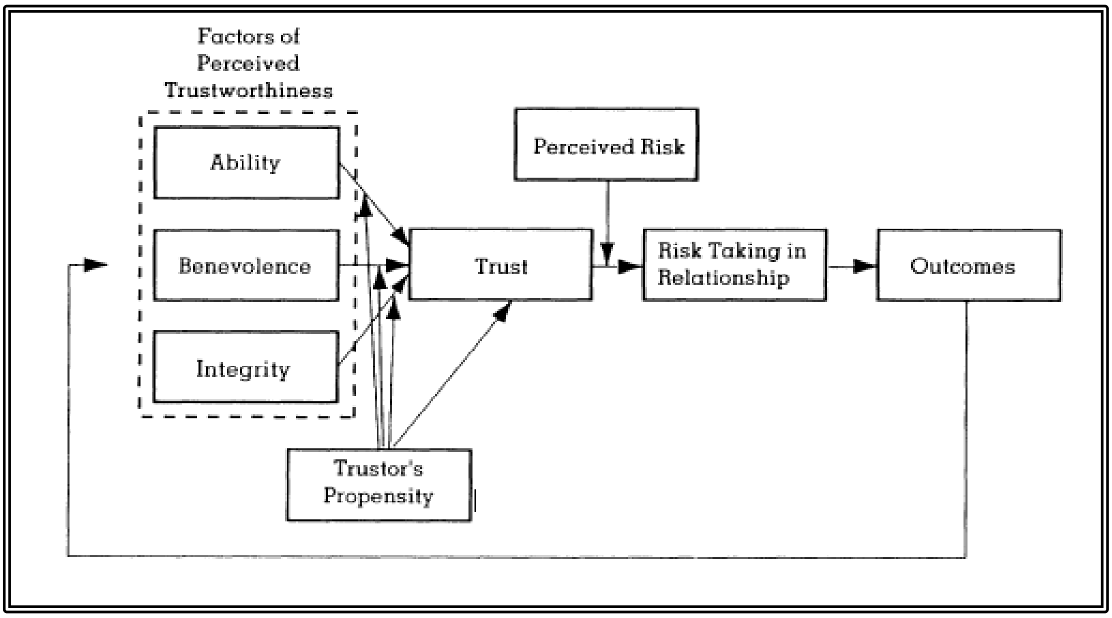

Figure 2: An Integrative Model of Organisational Trust (Mayer, Davis and Schoorman, 1995).

The key elements of the IMOT have been explained as below:

3.6.1.1 Factors of Perceived Trustworthiness

The IMOT explains the trustee's characteristics which the trustor must consider in order to trust him. These characteristics are termed "factors of perceived trustworthiness". They include ability, integrity and benevolence. According to Mayer, Davis and Schoorman, the factors of perceived trustworthiness are responsible for trust because they provide an explanation of why a trustor must trust a trustee.

Mayer, Davis and Schoorman's proposed that:

- Trusting a trustee is a function of his perceived ability, integrity and benevolence.
- Ability is a very influential factor of trustworthiness because the trustee's high level of competence (e.g in a technical area) may afford him trust on services related to that area of expertise.
- The effect of integrity on trust will be most noticeable in the early stage of relationship before developing a meaningful benevolent data.
- The effect of benevolence on trust will increase with time as the relationship between the two parties develops.

In support of the work of Mayer, Davis and Schooman, the result of their work (Gill et al., 2005) on participants' perception about their co-worker's trustworthiness, revealed that perceived ability, integrity and benevolence of a co-worker influenced the participants' intention to trust the co-worker. Gill, et al. also mentioned that the level of trust increases when an individual perceives a co-worker's ability, integrity and benevolence at high level.

3.6.1.2 Characteristics of the Trustor

According to Mayer, Davis and Schoorman (1995), some people are more likely to trust than others. As a result, the characteristics of the trustor is a major factor that influences how he will trust another. Rotter (1967) explained trust in a more generalised form such as something that is similar to that which a person will carry from one situation to another. One of the items used in Rotter's scale of trust measurement suggests that "when dealing with strangers it is better for one to be cautious until they have proven to be trustworthy" and "parents usually can be relied upon to keep to their promises".

In a similar way, Dasgupta (1988) explained trust as generalised expectations of others. This means that trust can be seen as a "trait that leads to generalised expectation about the trustworthiness of others" (Mayer, Davis and Schoorman, 2007). In the IMOT, this trait is regarded as propensity to trust.

Propensity to trust could be seen as the general willingness that a person (trustor) will trust another (trustee). As explained by Mayer, Davis and Schooman, people have different forms in their propensity to trust. According to Hofstede (1980), people with different personality types, cultural backgrounds and developmental experiences vary in their propensity to trust. Some people can repeatedly trust in situations that others would see as not warranting to trust. This was described by Mayer, Davis and Schooman as "blind trust".

Mayer, Davis and Schoorman proposed that "trust for a trustee will be a function of the trustor's propensity to trust" and "the higher the trustor's propensity to trust, the higher the trust for a trustee prior to availability of information about the trustee". In summary, propensity influences how much trust a trustor will have on a trustee depending on the situation on which the trust was built.

3.6.1.3 Characteristics of the Trustee:

The characteristics exhibited by the trustee are seen as the concept of trustworthiness. This is one approach to understand why a person (trustor) will have a greater or lesser amount of trust for another (trustee). Trustworthiness can be assessed in different ways. For example, the study carried out by Hovland, Janis and Kelly (1953) revealed that credibility is influenced by two factors (expertise and trustworthiness) which affect trust. Good (1988) suggested that trust is based on an expectation about the behaviour of another, which could be based on that person's previous or current implicit and explicit state. Lieberman (1981) also revealed that "trust in fiduciary relationship is based on some belief in the professional's integrity and competence". All these authors suggested that actions and characteristics of a trustee will lead to him being more or less trusted. These characteristics are significant in understanding why some parties seem to be trusted more than others.

3.6.1.4 The Role of Risk

It has been argued by many researchers (see Johnson-George and Swap, 1982 and Kee and Knox, 1970) that risk is an important component of the trust model. Mayer, Davis and Schooman (2007) explained that there is no risk taken in one's willingness to trust but there is risk in the behavioural manifestation of the willingness to trust. This means that one does not have anything to risk in order to trust but one must take risk in order to engage in the act of trusting.

According to Mayer, Davis and Schoorman (1995), the major difference between trust and trusting behaviours is the willingness to "assume risk" and actually "assuming the risk". These authors further explained that trust is the willingness to assume risk and behavioral trust is actually assuming the risk. This explanation is the same with that of the risk-taking literature (Sitkin and Pablo, 1992) between the willingness to take risk and the actual risk behaviour. As proposed by Mayer, Davis and Schoorman (1995; 2007), risk taking in relationship is a function of trust and perceived risk of the trusting behaviour. This distinction clearly explains the difference between trust and its outcomes.

3.6.1.5 Outcomes

Trust results in risk-taking in a relationship but the type of risk to be taken depends on the situation. A trustor's perception of a trustee will enhance when the risk he takes in trusting that trustee yields a positive outcome but conversely, if the trust leads to an unfavourable outcome, his perception about the trustor will decline (Mayer, Davis and Schooman, 1995). For instance, these authors explained that if a manager allots an employee a task that is very critical to the manager's appraisal, if the employee performs well on the task, the manager's perception about the employee's trustworthiness is enhanced. On the other hand, if the employee's performance on the task is poor, it results in damaging the manager's reputation and the manager's perception about his trustworthiness is declined. The manager may then attribute the employee's performance high or low in terms on ability, integrity and benevolence depending on the situation.

In conclusion, the outcome of trusting behaviour whether favourable or unfavourable, will indirectly influence trust at the next interaction through the perceptions ability, integrity and benevolence (Mayer, et.al 1995).

3.7 OPERATIONALISATION OF TRUST IN THIS RESEARCH.

Trust has been operationalised in this researched based on Mayer, Davis and Schoorman's (1995) definition of trust (using the IMOT framework). In many disciplines, including information systems, this is the most widely acceptable definition of trust: "Trust is the willingness of a party to be vulnerable to the actions of another based on the expectation that the other party will perform a particular action that is important to the trustor regardless of the trustor's ability to control or monitor that other party" (LePine and Wilcox-King, 2010).

With respect to cloud computing, trust is very important especially when it relates to the service providers and their clients. Sun, et al. (2011) revealed that integrity, ability or competency of the service providers are carefully considered in building a trust relationship that involves sensitive data. In this research, trust is operationalised in terms of the cloud service provider's ability, integrity and benevolence. Each of these three factors is a unique contribution to trustworthiness (Mayer, Davis and Shoorman, 1995). These authors also explained that if a trustee is perceived to be high in all three factors, the tendency of trusting that trustee will be very high. These three dimensions of trust (ability, integrity and benevolence) and other factors considered important for meeting the research objectives have been used to develop a conceptual model for the research (please see chapter 5). The IMOT's factors of perceived trustworthiness form the trust aspect of the conceptual model.

Several models (see Dirks, Lewicki and Zaheer, 2009; Mollering, 2007; Bsteiler, 2006 and Cote and Latham, 2006) have been proposed to explain trust at both the individual and organisational level. However, the IMOT is considered most suitable for this research because it provides a clarification between two individuals and reasons why the trusting party (SME) would trust the other (CSP).

An individual's belief about a specific feature of an object (e.g the CSP's ability, competence, integrity and benevolence) will affect their intention to trust that object (Grabner-Krauter and Kalyscha, 2003). This research proposes the following trust elements as client's expectation from their CSP (as an object of trust). Based on these elements, trust relating to cloud service providers can be better explained.

3.7.1 ABILITY-BASED TRUST ELEMENT

According to Mayer, Davis and Shoorman (1995), an individual can measure the trust of others through their ability (skills, knowledge and competence). Intention to trust depends on the trustee's disposition of the trustor (Gill et al., 2005). With respect to cloud computing, the CSPs ability to deliver skilfully can increase their clients' level of trust, which can contribute to the adoption and usefulness of cloud service.

3.7.2 INTEGRITY-BASED TRUST ELEMENT

Integrity refers to the extent at which a trustor perceives that the trustee is acting in accordance with certain principles that the trustor finds acceptable (Gill, et al., 2005). High level of CSP's ability, integrity and benevolence result to high trust conditions, by their clients.

3.7.3 BENEVOLENCE-BASED TRUST

Benevolence refers to the extent to which a trustor believes that a trustee is acting in his best interest (Gill, et al., 2005). As one of the characteristics of a trustee, Gill, et al. explained that benevolence influences the trustor's intention to trust. This could be particularly true when referred to cloud computing, in the case of the CSPs and their clients.

3.8 PREVIOUS RESEARCH ON THE INTEGRATIVE MODEL OF ORGANISATIONAL TRUST.

The following studies used Mayer, Davis and Schoorman's (1995) trust concept. Jason, et al. (2007) carried out a meta-analysis test between trust, trustworthiness and trust propensity with risk taking and job performance. Following some literature searches using synonyms, examples and definitions from the conceptual articles of Mayer, Davis and Schooman (1995) and Mayer and Davis (1999)'s trustworthiness measures, Jason, et al. developed some hypotheses. They used Hunter and Schmidt's (2004) guidelines (e.g weighted mean estimate of study correlations) to carry out a meta-analysis of 132 independent samples.

It was reported that the meta-analytic structural equation modelling carried out supported a partial mediation model where trust propensity was related to trust and all three trustworthiness dimensions (ability, integrity and benevolence), while controlling for trust. Also, a moderately strong relationship was found between trust and risk taking as well as trust and all three variables of job performance (task performance, citizenship behaviour and counterproductive behaviour). Further analysis revealed that the trustworthiness dimensions predicted affective commitment, which had a unique relationship with behavioural outcomes when controlling for trust.

Grabner-Krauter and Faullant (2008) investigated the conceptualisation of internet trust as a type of technological trust and its role in the process of adopting internet banking. These authors also investigated the integration of Mayer, Davis and Schoorman's (1995) propensity to trust within the hierarchical structure of personality and its applicability to technological systems. Grabner-Krauter and Faullant developed a model termed Basic Model of Adoption of Internet Banking. This model was empirically tested using 381 bank customers (adopters and non-adopters) in Austria. Their findings revealed that the propensity to trust determined trust in technological systems as well as interpersonal relationships. It was also reported that internet trust was influenced by perceived risk and consumer attitudes towards internet banking.

This study was reported as non-representative. As a result, Grabner-Krauter and Faullant encouraged future research to further investigate the facets of personality structure in trust and adoption, and also test interaction effects on psychological determinants (from their study) and other external website characteristics.

In their work, Antecedents of Trust in Supervisors, Subordinates and Peers, Knoll and Grill (2011) assessed the generalisability of Mayer, Davis and Schoorman's (1995) IMOT, to the development of workplace trust in upward, downward and lateral relationships. This study also examined the relative importance of ability, integrity and benevolence in predicting trust in supervisors, subordinates and peers. Using 187 human resource professionals from two Canadian organisations, Knoll and Grill collected data through an online survey.

According to their findings, the IMOT was applicable to trust in supervisors, subordinates and peers. Again, their result suggested that the relative importance of ability, integrity and benevolence in predicting trust differed according to the trustee-trustor dyad. This study is limited because it obtained data regarding trust in supervisors, subordinates and peers from the same raters. Therefore, Knoll and Grill suggested the replication of their study which should involve the collection of data from several sources.

Hwang and Lee (2012) investigated the moderating role of uncertainty on the relationship between subjective norms and online trust (ability, integrity and benevolence) as well as purchase intentions. These authors developed a model integrating Davis (1989) Technology Acceptance Model and the factors of perceived trustworthiness (Mayer, Davis and Schoorman, 1995). To test their model, Hwang and Lee collected data from undergraduate business students from a university in the northern region of USA. Data was collected using a questionnaire conducted in an Internet classroom where students used their own computers.

The findings reported on this paper, revealed that uncertainty avoidance moderated the relationship between two dimensions of cognitive-based trust (ability and integrity) and subjective norms. On the other hand, benevolence was not found to have any relationship with purchase intensions or cultural values. Again, normative influence on ability belief about website was only significant when the online user had a high sense of uncertainty avoidance.

The study carried out by Poon (2013) examined the predictive effect of Mayer, Davis and Schoorman's (1995) trustworthiness attributes (ability, integrity and benevolence) on trust in supervisors. A field survey was carried out using a structured questionnaire to collect data from 107 employees of white-collar jobs from different organisations in Malaysia. Using hierarchical multiple regression analysis, this study reported that trust in supervisor was directly and indirectly predicted by perception about the supervisor's ability, integrity and benevolence. Secondly, ability and integrity interacted in a compensatory manner to predict trust in supervisor when benevolence was high but not when it was low. This research is limited to the use of self-reported cross-sectional data. As a result of this, Poon advised that further research should consider investigating three-way interaction effects in examining the trustworthiness attributes (ability, integrity and benevolence).

3.9 CHAPTER SUMMARY

Generally, trust is believed to be a significant factor in building interfirm relationships (Jeffries and Reed, 2000). It leads to positive outcomes such as competitive advantage, performance, perceived risk reduction and satisfaction (Zaheer, et al., 1998). This research explains the role of trust in cloud computing usage and adoption by adapting Mayer, Davis and Schoorman (1995) factors of perceived trustworthiness (ability, integrity and Benevolence). These three dimensions of trust are seen as the characteristics of the cloud service provider which the clients should consider in their decision to adopt cloud services as well as subsequent usage. These dimensions have been used in line with other factors to produce a model (see chapter 5) which better explains the processes involved in cloud computing usage and adoption.

CHAPTER 4

REVIEW OF THEORIES RELATING TO TECHNOLOGY ACCEPTANCE AND ADOPTION

This chapter presents a review of theories relating to technology/innovation acceptance. It begins by briefly reviewing seven model/theories in order to determine the one most suitable for the research. Then it presented a detailed review of the theories chosen for the study in line with the previous studies that have used them (either individually or in combination with other models). Finally, a chapter summary was given.

4.1 INTRODUCTION

According to Tehrani and Shirazi (2014), many factors affect technology diffusion in the business world. Over the past few decades, several researchers (Amini, 2014; Gupta, Seetharaman and Raj, 2013; Oliviera and Martins, 2011; Low, Chen and Wu, 2011; Zhu and Kraemer, 2006 etc.) have attempted to identify the various factors influencing the diffusion of several technologies using different models and theories. From the various acceptance models used in information acceptance research, researchers are also faced with the challenges of determining the best model suitable for their study.

For the purpose of this research, an evaluation of seven models/theories has been made to determine their suitability for the research. The first model was the IMOT (relates to trust in the organisational setting) discussed in section 3.5.1 above. The rest six models relate to theories that inform people's behaviours towards decision making or towards the decision to accept a new technology. These are the "Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980), Theory of Planned Behaviour (TPB) (Ajzen, 1985; 1991), Technology Acceptance Model (TAM) (Davis, 1986; 1989), Diffusion of Innovation (DOI) Theory (Rogers, 1995; 2003), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, et al., 2003) and Technology Organisation Environment Framework (TOE) (Tornatzky and Fleischer, 1990). Majority of these theories and models try to explain and predict the factors behind user's decision to adopt a technology (innovation) based on the user's behaviour/perception about the technology and its characteristics. The TRA, TBP, TAM, UTAUT mainly focus on decision making at the individual level.

The TRA explains that a person's intention to behave in a certain way depends on his attitude about the behaviour and the surrounding subjective norms. In other words, if it is his intention to behave in a certain way, then he is very likely to do the behaviour (Bagozzi, et al., 2014).

Subjective norms (People around him) will also influence his behavioural intentions. TPB explains that an individual's attitude towards behaviour, perceived behavioural control and subjective norms determine his behavioural intentions to act. TPB is a theory that links belief and behaviour. It explains the relationship between intention to act and the actual behaviour. The only difference between the TRA and TPB is that the TPB was an extension of the TRA with the inclusion of the perceived behavioural control.

TAM uses the TRA as its foundation but removed the subjective norm variable on the belief that it has little impact on behavioural intention or user acceptance of a technology (Legris, et al., 2003). TAM specifies the causal linkage between the two primary determining variables, perceived ease of use and perceived usefulness, to explain technology adoption and use behaviour (Davis, et al., 1989). TAM implements these two independent variables as the primary determinants of user acceptance (Legris, et al., 2003). Perceived usefulness is defined as the degree to which a person perceives that a specific technology will increase his or her job performance while perceived ease of use is the degree to which a person believes that using a particular technology would be free from efforts (Davis, et al., 1989).

The UTAUT was developed by Venkatesh, et al. (2003) for user acceptance of information technology. The elements that make up the UTAUT model were derived from eight theoretical models: The Technology Acceptance Model, Theory of Reasoned Action, Theory of Planned Behaviour, Motivational Model, The Combined Technology Acceptance Model and Theory of Planned Behaviour, Model of PC Utilisation, Innovation Diffusion Theory and Social Cognitive Theory" (Sundaravej, 2010; Tan, 2013). UTAUT constructs consist of performance expectancy, effort expectancy, social influence, facilitating conditions, behavioural intention, and use behaviour with the moderating variables of experience, voluntariness, gender, and age (Venkatesh, et al., 2003). Performance expectancy relates to the TAM's perceived usefulness. This includes how useful an individual perceives a technology, his expectations for using the technology and how the technology will help his job performance (Venkatesh, et al., 2003). Effort expectancy relates to the TAM's perceived ease of use. This includes the experience and how easy it is to use the technology. Social influence derives from the Theory of Reasoned Action and it is similar to the TRA subjective norms. Social influence refers to how important a user thinks that other people perceive the technology, including how it fits into the social norms, what others think in regards to if they should or should not use the technology and the user beliefs of their self-image (Venkatesh, et al., 2003).

Among these models, the DOI and TOE were chosen for this study. This is because the constructs introduced by these models are considered robust enough for meeting the research objectives. A detailed review of the DOI and TOE frameworks are given below.

4.2 DETAILED REVIEW OF THE DOI AND TOE FRAMEWORKS

4.2.1 THE DOI

According to Rogers (2003), the DOI explains the entire process of diffusing of a new idea or innovation in a society. An innovation takes a period of time to gain acceptance in a society. This involves the adoption process. The following figure represents the adoption process of an innovation (see Rogers, 2003). This process involves knowledge about the innovation, persuasion, decision to adopt or not, implementation and confirmation.

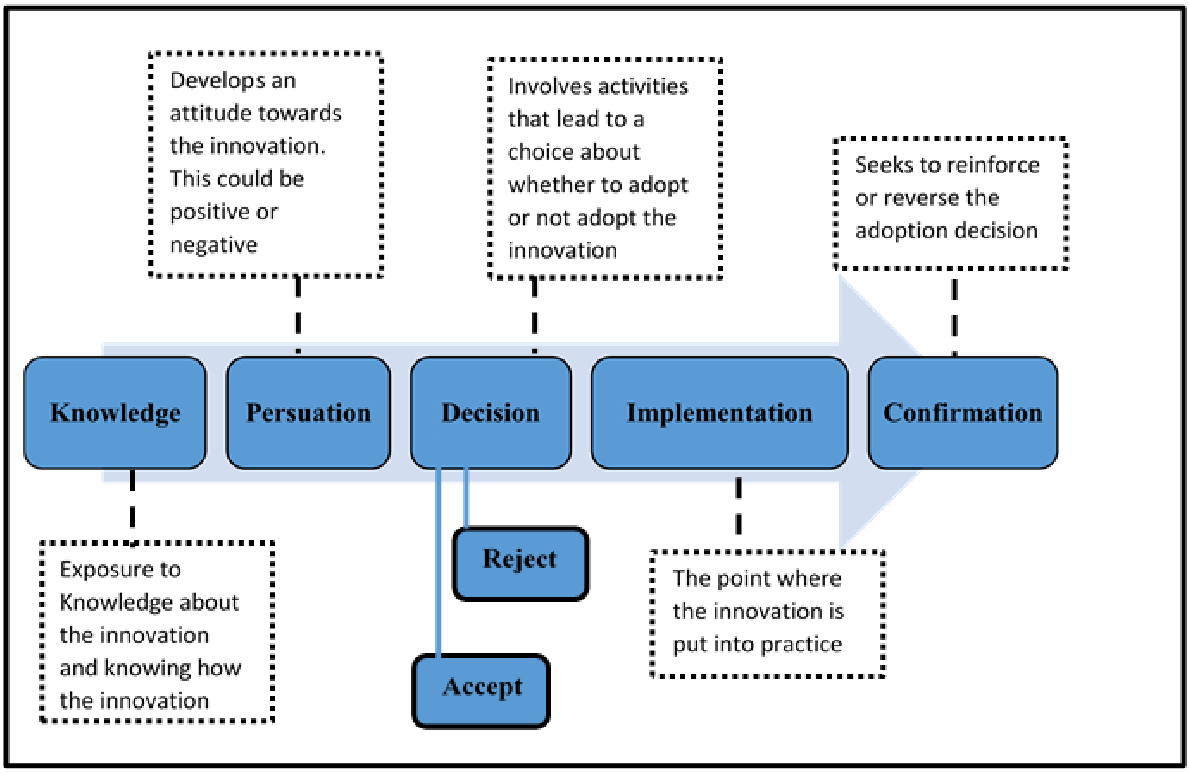

Figure 3: The Innovation Adoption Process (Rogers, 2003).

From the figure above, the first stage of the innovation diffusion process is the knowledge stage. According to Rogers, this stage is when people come across an innovation but they do not have any knowledge about it. At this stage, the individual may or may not be inspired to find out more about the innovation. When the individual becomes inspired about the innovation, the persuasion stage starts. This is when the individual tries to find out every detail or information about the innovation. The individual compares the advantages and disadvantages of the innovation then takes a decision to adopt or reject the innovation (the decision stage). When the individual accepts the innovation, he begins to think how to start the implementation stage. The implementation stage is when individual starts using the innovation. This could be a trial stage. Based on any experience gathered, the individual determines whether the innovation is useful or not. If he finds the innovation useful then he will find more information about it and how to continue using it. This is the point where the confirmation stage starts. It is when the individual recognises the benefits of the innovation then promotes it to others.

An innovation involves some key elements which should be considered when making an adoption decision. These elements are the innovation itself, the communication channel which it passes through to gain acceptance, the time it takes to gain acceptance and the social system. The figure below shows the characteristics of the DOI process. These characteristics according to Rogers, are considered essential for any innovation to be successfully diffused in a society.

DIFFUSION OF INNOVATION THEORY (ROGERS, 1962)

KEY ELEMENTS

- **Innovation**
- **Communication Channels**
- **Time**
- **Social System**

FACTORS OF INNOVATION

- **Relative Advantage**
- **Compatibility**
- **Complexity/Simplicity**
- **Trialability**
- **Observability**

DECISION MAKING

- **Optional Innovation Decision**
- **Collective Innovation Decision**
- **Authority Innovation Decision**

STAGES OF ADOPTION PROCESS

- **Knowledge**
- **Persuasion**
- **Decision**
- **Implementation**
- **Confirmation**

CATEGORIES OF ADOPTERS

- **Innovators**
- **Early Adopters**
- **Early Majority**
- **Late Adopters**
- **Laggards**

Figure 4: Characteristics of Diffusion of Innovation

Beside all other characteristics of innovation diffusion in the society, this study mainly focuses on the factors of innovation. According to Tehrani (2013), an innovation refers to a novel idea, product, process, technology which is seen as new by individuals. According to Rogers (2003), each innovation or idea has different factors that influence its successful diffusion within a society. These factors have been explained below:

- **Relative Advantage:** This is defined as "the degree at which an innovation is better than the one it supersedes". It considers how relevant an innovation is to the needs of potential adopters. As mentioned by Tehrani (2013), relative advantage often has a positive influence on the adoption of an innovation.
- **Compatibility:** Compatibility of an innovation is "the degree to which an innovation is perceived as being consistent with past experiences, existing values and needs of its potential adopters". In essence, compatibility of an innovation positively influences the widespread adoption of that innovation in a society (Tehrani and Shirazi, 2014). This means that an innovation which is compatible with the norms and values of a society or an individual, often spreads faster than that which is not.
- **Complexity or Simplicity:** This defines how an individual perceives the innovation in terms how it can be used. It explains the extent of how difficult or how simple an innovation is to use. This determines whether the innovation would be adopted or not. Usually, complexity of an innovation has a negative influence on its diffusion (Tehrani, 2013). This means that a more complex innovation has less chances of diffusion in a society.
- **Trialability:** In the work of Rogers (2003), Trialability was defined as "the degree to which an innovation can be experimented on a limited time". In this regard, if a user is able to test an innovation easily and enjoys the features, then there is a possibility that that user would more likely adopt it.
- **Observability:** Observability takes into account the extent to which an innovation is visible to others. A more visible innovation would drive communication among individuals and create personal networks which will give room to more positive or negative reactions.

According to Tornatzky and Klein (1982), among the factors of innovation, relative advantage, complexity and compatibility have most significant influences on the adoption rate of different types of innovation.

4.2.1.1 PREVIOUS RESEARCH ON DIFFUSION OF INNOVATION THEORY

In different fields, Rogers' DOI theory has been extensively used by different scholars. Majority of these scholars used the constructs of the DOI theory to either examine the diffusion of an innovation or confirm the validity of their research models. As explained by Rogers, innovation diffusion varies with the five factors of innovation explained above. The following table provides a summary of previous studies that used the DOI theory.

STUDIES THAT USED DOI THEORY				
AUTHOR	RESEARCH/ MODEL USED	METHODS	MODEL DEVELOPED	FINDINGS
Cooper and Zmud (1990)	Diffusion and Infusion of Material Requirement Planning (MRP) systems.	Coopper and Zmud used cross-sectional field survey through phone interview by random sampling American Production and Inventory Control Society members.	They developed a model to investigate the influence of managerial tasks on information technology.	Their findings revealed that 1. Properly positioned managerial rationality was an influential factor on diffusion of innovation. 2. Political interests affect the decision to adopt innovation. These authors argued that their model was not successful because of the inclusion of political forces within the organisation.
Thong (1999)	Investigation of Information Systems (IS) adoption by small businesses.	Thong used a quantitative method through a questionnaire survey of 166 small businesses.	This author developed a model to argue that 4 categories of constructs which are	Thong found that information systems knowledge, innovation's relative advantage, complexity, compatibility, business size, decision

		He used discriminant analysis to test their research hypothesis	- Environmental characteristics - Organisational characteristics - Decision makers' characteristics and Information system characteristics, influence the adoption decision of new information systems and the extent of its adoption.	makers' innovativeness and employees IS knowledge has a positive influence on IS. Also, organisational characteristics was found to determine the extent of IS adoption while environmental factors were not reported influential in the adoption of information systems by small businesses.
Eder and Igbaria (2001)	Diffusion of Intranets in organisations.	They carried out a cross-sectional survey using 1000 senior computer executives from American organisations. They used hierarchical multiple regression to analyse their data. Then performed principal	Using the DOI theory and other additional variables, Elder and Igbaria developed a model to investigate the diffusion of intranets in the United States.	Their findings explained that the following constructs influence the diffusion of intranets. 1. Organisational size 2. Top management support and 3. Earliest of adoption. Also, earliest of adoption, flexibility, top management support and

		component analysis to test the discriminant and convergent validity of their survey items.		IT infrastructure were found to be positively associated with intranet infusion.
Bradford and Florin (2003)	Investigating the adoption of Enterprise Resource Planning (ERP).	Bradford and Florin developed questions based on already existing questions using information system managers to complete their survey. They used linear technique to analyse their data.	These authors developed a model to study the success of ERP implementation using three categories of variables (Organisational characteristics, innovations characteristics and environmental characteristics).	Bradford and Florin defined implementation success as organisational performance and user satisfaction. They found that 1. Top management support and training had a positive relationship with user satisfaction. 2. Competitive pressure and perceived complexity had a negative impact on user satisfaction. 3. Consensus in organisational objectives was positively associated with perceived organisational performance. They conducted a post hoc analysis and it identified user satisfaction as a moderating factor between organisational

				performance and certain DOI characteristics (e.g. top management support).
Tan, et al., (2009)	Investigation of internet-based ICT adoption by SMEs.	These authors used questionnaire-based survey as a tool for data collection from 406 owners and managers of SMEs in Malaysia. They used multiple regression analysis to test their research hypothesis.	These authors developed a model by adding some constructs to the original DOI constructs.	Their findings revealed that 1. Security is a barrier to internet-based ICT adoption. 2. Compatibility, relative advantage, complexity and observability influence the adoption of internet-based ICT.
Gollakota and Doshi (2011)	Investigating the diffusion of rural telecentres in developing countries.	These authors used a case study method using one of the largest telecentres "eChoupals" in India.	They developed a model using the DOI characteristics.	Their finding revealed that 1. Knowledge, information about a technology and sufficient infrastructures have significant influences on the diffusion of rural telecentres in developing economies. 2. The diffusion of rural telecentres is positively associated with the use of telecentres, importance of perceived complexity and

				visibility, and the consideration of exiting practices and traditions.

Table 2: A Summary of Previous Studies on the Diffusion of Innovation Theory.

In general, studies reviewed in the table 2 above show that the constructs of the DOI theory are very useful in investigating different forms of innovation acceptance. The DOI theory is commonly used because it tries to provide an explanation and prediction at the adoption stages of innovations (Staurt, 2000; Tehrani, 2013). Being that most of these studies relate more to technology acceptance, the DOI was considered one of the suitable models for investigating the adoption process of cloud computing by SMEs. However, bearing in mind SMEs' uptake of cloud computing, the DOI does not consider environmental factors in which the organisations carry out their business transactions (for example competitive intensity, which could be a motivator or barrier to adoption). This is one common criticism of the DOI (see Lippert and Govindarajulu, 2006).

In their work (Raus, Liu and Kipp, 2010), the adoption of an innovation by an individual is different from that of the organisation in terms of factors that impact such adoption. According to Carter (2008), an organisational innovation is a new system, service or process that is either purchased externally or developed internally. This definition implies that an organisation replaces an existing system in order to improve the efficiency and effectiveness of its performance (Mohama and Ismaild, 2009).

One major consideration for deciding to adopt such innovation is the environment where it operates. According to Lippert and Govindarajulu (2006), competitive pressure is a major factor impacting on organisational decision to adopt an innovation. Based on this understanding, the integration of DOI and TOE frameworks would serve as a useful theoretical framework in explaining the adoption of cloud computing by SMEs. Such approach could provide a strong empirical support to cloud computing adoption by accounting for technological, environmental, organisation and individual factors, which influence the adoption of cloud computing by SMEs. This is in support of Al-Zoubi, et al. (2011) statement regarding the usefulness of integrating the DOI and TOE frameworks.

The DOI theory takes into account the individual, technological and organisational features but not the environmental or trust-related features. In their work (Zhu et al., 2006a), the combination of both the DOI and TOE models was found to better explain post-adoption usage of e-commerce when compared to having just one of them.

According to Oliveira and Martin (2011), most empirical studies in technology acceptance are derived from the combination of the TOE and DOI frameworks. They also mentioned that since TOE contains the environmental features which are not contained in the DOI theory; it makes it better and easier to explain innovation adoption at the intra-firm level. Oliviera and Martin further revealed that the TOE framework has more consistent empirical support, solid theoretical foundation and applicability in the adoption of technological innovations.

Both the DOI and TOE treat technology innovation and organizational characteristics with equal importance. While the DOI explains that there are also individual traits that impacts innovation diffusion, the TOE provides additional insights with the inclusion of environmental factors.

4.3 TECHNOLOGY ORGANISATION ENVIRONMENT FRAMEWORK (TOE)

In the course of studying the processes involved in the acceptance of technological innovations, the TOE framework was developed. This framework was developed by Tornatzky and Fleischer in 1990. In their book titled “The Processes of Technological Innovation”, the process of innovation acceptance was discussed. This follows from when an innovation is developed to its adoption and implementation but within the context of a firm.

The basic principle behind this framework explains how firms influence the adoption and implementation of new technologies. As an enterprise-based theory, the TOE framework explains how three aspects of an enterprise influence the decision to adopt a new technology. These three aspects are the development of a firm’s technology, organisational readiness and the environmental conditions surrounding the firm. When compared with the DOI theory (which focuses on both individual and organisational level adoption), TOE framework focuses mainly on firm level adoption.

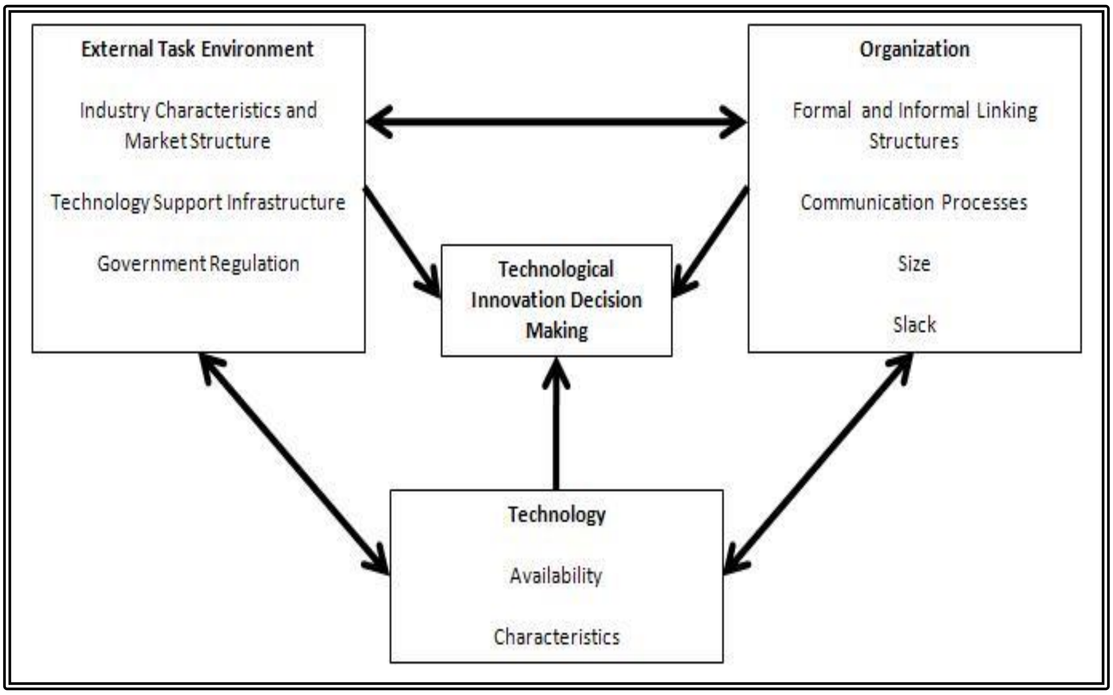

Figure 5: Technology Organisation Environment Framework (Tornatzky and Fleishchner, 1990).

4.3.1 KEY ELEMENTS TOE FRAMEWORK

4.3.1.1 THE TECHNOLOGICAL ASPECT:

This consists of all technologies relevant to a firm which include those already in use and those not currently in use but are available for purchase in the marketplace (Tornatzky and Fleishchner, 1990). According to Baker (2012), existing technologies within a firm are considered important to the firm's decision to adopt a new technology. This is because they provide a definition for the scope and limit in the amount of technological change that a firm can accommodate. Baker also explained that technologies not currently in use by a firm but are available for purchase in the marketplace can also influence a firm's adoption decision. This is because they explain how firms can evolve if they adopt them.

As mentioned by Tornatzky and Fleishchner (1990), technologies existing outside a firm's boundary comprise of three types. These are those that create incremental changes, synthetic changes and discontinuous changes. Those creating incremental changes have the lowest risk amount because they only provide new features to existing technologies. Those creating synthetic changes have moderate risks because they are combined with the existing technologies in a novel way. And those creating discontinuous changes are totally different from the existing technologies (Baker, 2012). Regardless of these three types of technologies, the availability and characteristics of the technologies are very essential in a firm's adoption decision

4.3.1.2 THE ORGANISATIONAL ASPECT

This explains the basic features and resources of an organisation. They include the size of the organisation, intra-firm communication process, linkages structures among employees, amount of slack resources and managerial structure. These features affect a firm's adoption and implementation decision in so many ways (Tehrani and Shirazi, 2014). The size of an organization, its structure (both formal and informal), its communication process and slack promotes or inhibits its decision to adopt a technology. Size and slack are among the most frequently discussed features within the organisational context. While some researchers argue that organisational slack impacts adoption innovation (see March and Simon, 1958; Rogers, 1995), other works indicate that without this factor, innovation adoption can still take place (see Tornatzky, et al., 1983).

According to Tornatzky and Fleischer (1990), slack is helpful and desirable but neither necessary nor sufficient for innovation to occur. In terms of size, many researchers (see Sabherwal, et al., 2006; Jeyaraj, et al., 2006) argue that larger organisations are generally more likely to adopt an innovation than the smaller ones. In his work (Densmore, 1998), the proportion of adoption of electronic data interchange amongst larger firms was about 95% while about 2% in smaller firms. The work of the Organisation for Economic Co-operation and Development (OECD) in 2000, also revealed that the adoption of internet and its infrastructures by business organisations is slower in smaller firms than in larger ones (Awa, Ojiabo and Emecheta, 2015). Although, Tehrani and Shirazi (2014) states that it is the belief of most researchers that the rate of adopting a technology is higher in fast growing companies that it is in already mature or slow growing companies.

On the other hand, communication process can also inhibit or promote adoption. For example, top management can encourage adoption by creating an organisational structure that welcomes change and support of innovations which promotes the organisation's mission and vision (Baker, 2012).

4.3.1.3 THE ENVIRONMENTAL ASPECT

This relates to the factors involved in the firm's operational activities. They are industrial characteristics (consumer readiness, competition intensity, trading partners' readiness), availability of skilled labour, market structure, technology support infrastructure and government regulations (Tehrani, 2013). Baker (2012) explained that the impact of government is not very clear in the innovation adoption process. He further explained that government regulations can either support or inhibit innovation adoption.

The major drawback of TOE framework is that some of the constructs that predict adoption are assumed to be applied to bigger organisations where continuity is assured and without much complains compared to smaller organisations. As a result, it would be worthwhile to integrate TOE with other models to provide richer variables in studying and understanding the adoption of a new technology (Awa, Ojiabo and Emecheta, 2015).

4.3.2 PREVIOUS RESEARCH ON TOE FRAMEWORK

Similar to the DOI theory, the TOE framework has also been widely used by researchers to study the adoption of new technologies in the field of information system. The TOE framework has been used in many studies as the only theoretical framework to investigate the process of adopting innovations. It has also been used in line with other theories or frameworks to investigate the adoption process of new technologies. The table below shows some studies that solely used the TOE framework to investigate the adoption of new technologies.

STUDIES THAT USED TOE FRAMEWORK				
AUTHOR	RESEARCH	METHODS	MODEL DEVELOPED	FINDINGS
Kuan and Chau (2001)	A perception-based investigation of the adoption of Electronic Data Interchange (EDI) by small businesses.	These authors used case study and survey-based approaches using 575 small businesses in	Kuan and Chau designed a model to investigate the perception of EDI by small	They found that 1. In their hypothesis relating to environmental context, instead of adopter firms perceiving higher level of industrial pressure than non-adopter firms, it

		Hong Kong. For their data analysis, they used factor analysis and Logistic regression.	business using TOE variables.	was the other way round – they perceived lower level of industrial pressure than non-adopter firms. 2. In their hypothesis relating to organisational context, adopter firms perceived lower level of financial cost and higher level of technical competence. 3. In technological context, they found that adopter firms perceived higher level of direct benefits than non-adopter firms. Also the hypothesis stating that adopter firm perceives higher level of indirect benefits than non-adopter firms was not supported.
Oliveira and Martins (2008)	Investigating the adoption of website by small and large firms in Portugal.	This study used quantitative method using 3155 small businesses and 637 large businesses. Oliveira and Martins used multiple		Their findings revealed that the important factor that determines the adoption decision is size of the firm. Also, it was reported that the adoption drivers of websites by small and large businesses are:

		correspondence analysis and probit model in analysing their data.		1. Technology readiness. 2. Internal security application. 3. Technology integration. 4. Internet and email norms. 5. IT training programs. 6. Website competitive pressure and 7. Perceived benefit of electronic correspondence.
Lin and Lin (2008)	Investigating the determinants of e-business diffusion from technology-diffusion perspective.	By means of a telephone interview, Lin and Lin asked 1000 firms in China if they had adopted e-business and collected the details of their most senior executives. They removed those that were non e-business adopters. They	These authors developed a model by combining other variables (internal integration and external diffusion of e-business) with the original TOE's constructs.	Amongst the TOE's constructs they used, they found that IS expertise, IS infrastructure, competitive pressure and expected benefits of e-business had a significant influence on the adoption of e-business by large firms.

		got a final survey sample of 732 and out of this only 163 usable and completed responses were received back. They used Confirmatory Factor Analysis (CFA) to access the reliability and validity of their model constructs then Structural Equation Modelling (SEM) was used to test the relationships between the model constructs.		
Oliveira and Martins (2010a)	The adoption of e-business by firms across EU27 member countries.	These authors collected data from 6964 firms using the variables of TOE framework.		In general, they found that 1. Firms with higher level of TOE constructs enhanced the level of e-business adoption. 2. Environmental factors are very important in

		They performed factor analysis of multi-item indicators to test the validity of their questionnaire items and to reduce the number of variables.		improving e-business adoption. 3. Technological factors are more important in adopting e-business by manufacturing firms than they are in tourism firms. 4. Perceived benefits, obstacles of e-business, competitive pressure, trading partners' collaboration and technology readiness influence the decision to adopt e-business by those sampled firms. But internet penetration index had a negative impact on the adoption of e-business.
Ifinedo (2011)	Investigating the acceptance of Internet/E-Business Technologies (IEBT) by Canadian SMEs.	This author used a survey-based approach using a questionnaire to test the research framework. A total of 2200 questionnaires were sent to the participating SMEs using a		This author found that perceived benefits, external factors and management commitment/support are significant determinants of IEBT acceptance by the sampled SMEs. But no indication that IS vendor support, availability of financial

		stratified random sampling. Out of all questionnaires sent out, 192 were not delivered, 237 were received and 214 were considered valid. 23 were unusable because they included high percentage of missing entries as well as those indicating non-adoption. Data was analysed using Partial Least Square (PLS) techniques. CFA was used to measure the reliability and validity of the questionnaire items.		support and organisational IT competence were found to have a positive influence on the acceptance of IEBT by the sampled SMEs.

Table 3: A Summary of previous studies that used the TOE framework.

The TOE framework has demonstrated its robustness in several studies. Generally speaking, the studies reviewed so far have demonstrated that the TOE framework is very usefulness in studying different forms of technological adoptions. The TOE framework assumes that adoption is influenced by technological development, organisational conditions and industry environment (Chatterjee, Grewal and Sambamurthy, 2002; Kauffman and Walden, 2001).

The TOE framework has the potential of application to information systems domains, through the factors introduced within the three contexts. When compared with the DOI theory which focuses adoption on both individual and firm level (but excludes environmental context), the main focus of the TOE framework is at the firm level. Again some of its constructs that predict adoption are assumed to be applied to much larger companies compared to smaller ones.

The TOE framework is consistent with the DOI theory, where Rogers (1995) emphasised that the drivers for organisational innovativeness are individual characteristics and internal and external characteristics of the organisation. These are similar to TOE's technology and organisational context (Oliveira and Martins, 2010).

For this reason, a combination of both the DOI and TOE frameworks makes a better explanation of intra-firm innovation/technology adoption (Hsu, et al., 2006).

4.3.3 PREVIOUS RESEARCH THAT INTEGRATED THE DOI AND TOE FRAMEWORKS.

STUDIES THAT USED BOTH THE DOI AND TOE MODELS				
AUTHOR	RESEARCH	METHODS	MODEL DEVELOPED	FINDINGS
Thong (1999)	This author investigated the adoption of information systems (IS) by small businesses in Singapore.	Thong used a survey-based method. Out of the 1200 questionnaires sent out to small businesses in Singapore, only	Thong developed a model known as the Integrated Model of Information Technology Adoption by Small Businesses.	Using T-test, Factor Analysis, Discriminant Analysis and Partial Least Squares (PLS), it was reported that - Small businesses with certain CEO, innovation and organisational

		166 usable responses were retrieved.	He investigated variables such as CEO characteristics (IS knowledge and innovativeness), IS characteristics (complexity, compatibility and relative advantage) and Organisational characteristics (employees' IS knowledge, business size and information intensity)	characteristics are more likely to adopt information systems. Also, while both innovation and CEO characteristics are essential determinants of the decision to adopt IS, they do not necessarily affect the extent of IS adoption. On the other hand, organisational characteristics determine the extent of IS adoption. It was also reported that competition, one aspect of environmental characteristics had no effect on small business adoption of IS.
Zhu, et al. (2006a)	These authors investigated the Determinants of Post Adoption of Enterprise Digital Transformation by European companies.	Using innovation characteristics (cost, relative advantage, compatibility and security concerns) and four contextual factors (competitive pressure, organisational size, technology competence and	The developed model was used to study the stages involved in the post-adoption of innovation diffusion, with a focus on enterprise digital transformation.	Their findings revealed that innovation needs to be extensively used before its impact can be realised. From the studied innovation characteristics, compatibility was reported as the strongest driver while security concerns overweighed cost as usage inhibitor. In terms of contextual variables, competitive pressure and partner readiness were

		partner readiness as determinants of post-adoption usage, these authors proposed a model. This model was tested using 1415 dataset from six EU countries.		significant drivers of e-business usage. In simple terms, their results revealed that innovations diffusion can be better explained using both innovation characteristics and contextual factors.
Chong, et al. (2009)	Investigating the Determinants of Collaborative Commerce (C-Commerce) Adoption by Electrical Electronics Organisations in Malaysia.	The method used by Chong et al. was survey-based and case study of two major electrical and electronics companies in Malaysia with 10 of their suppliers. They developed a survey instrument to test their hypothesis using the data collected from literature review. Their survey respondents were randomly selected from the entire electrical and electronics	They developed a model using the variables introduced by TOE and DOI models.	They found that 1. Organisational readiness, external environment and information sharing culture had a significant impact on the decision to adopt c-commerce by organisations. 2. Information sharing culture had the strongest influence followed by organisational readiness. Although, technology adoption was found to have no significant influence.

		companies in Malaysia. They sent out 400 questionnaires then received 120 responses, indicating about 30% estimated response rate but only 109 were usable.		
Wang, et al. (2010)	The adoption of Radio Frequency Identification (RFID) by manufacturing firms in Taiwan.	Wang et al. used a survey-based approach to collect data from 133 manufacturing firms in Taiwan. They ran factor analysis to assess construct validity of their data measures.	They designed a conceptual model combining the variables introduced by the DOI and TOE models.	Their findings revealed that firm size, compatibility, information intensity, complexity, trading partners' pressure and competitive pressure had direct influence on the adoption of RFID by Taiwan manufacturing firms.
Tan (2010)	Using a perception-based model to investigate the adoption of technological innovations by SMEs.	Tan proposed mixed methods which included the use of qualitative interview and quantitative survey using large	Tan developed a perception-based model using TOE and DOI variables. Tan's intention was to study the key determinants and processes of ICT	No empirical result was given yet. It is still a work in progress.

		representative sample of SMEs in Australia.	and technological innovations adoption by SMEs.	

Table 4: Summary of Previous Studies that Integrated the DOI with TOE framework.

4.4 CHAPTER SUMMARY

In trying to develop the conceptual model for this research, several related models were reviewed. This was done to find the most suitable one for the study. The models include the TRA, TPB, TAM, UTAUT, DOI, TOE and IMOT. Constructs presented in the TRA, TBP, TAM, UTAUT were not adapted into this study. This is because, they mainly focus on adoption at the individual level. Also, they consider that individual intentions, behaviours and attitudes influence their decision to adopt a technology/innovation. These constructs were not deemed robust enough for meeting the research objectives. Also, the concept of trust was not introduced by any of these models.

In this research, the DOI and TOE frameworks were integrated together to explain the adoption of cloud computing at the organisational level. These models consider the technological, organisational, environmental and individual perspectives when making a technology/innovation adoption decision.

Al-Zoubi, et al. (2013) suggested that deploying theoretical perspectives such as the combination of DOI and TOE in future research would provide a very promising outcome. In order to study the factors involved in the adoption process of cloud computing by SMEs in UK, this study employed the DOI and TOE frameworks. Reasons being that the DOI considers technological, organisational and individual factors while the TOE considers technological, organisational and other external or environmental factors. These two models explain the adoption of a technology/innovation at the firm level.

Since the research main focus relates to trust in service providers, the variables introduced by the IMOT were added to the combined DOI and TOE frameworks to makeup a single model that explains the research concept better. This model provides a step-by-step guide for SMEs in their consideration for cloud adoption. It consists of factors which SMEs can use to assess their readiness towards cloud adoption and how to select service providers based on their reputation, evidence and trust dimensions (ability, integrity and benevolence). Full details of the model have been given in the next chapter.

CHAPTER 5

THE CONCEPTUAL MODEL

This chapter builds on the theoretical foundations which have been established in chapter 4. Its main purpose is to develop a conceptual model and its related hypothesis for this research. These hypotheses will be used to study the influence of trust and other factors on the adoption and usefulness of cloud computing. First, the chapter presented the conceptual model, all its variables and their descriptions. It further presented the developed hypotheses.

5.1 INTRODUCTION

The figure below illustrates the conceptual model proposed to study the adoption process of cloud computing by SMEs. This conceptual model consists of a combination of the three models adopted in the study as its theoretical foundations. These models have been extensively explained to chapters 3 and 4. They are the DOI, TOE and IMOT. The DOI and TOE were considered in studying the organisational, technological, individual and environmental factors proposed to influence the adoption and usage of cloud computing by SMEs. The IMOT is the Mayer, Davis and Schoorman's (1995) model which explains the concept of trust at the organisational level. The IMOT have been used with the DOI and TOE to better explain the role of trust in cloud computing adoption and usage by SMEs.

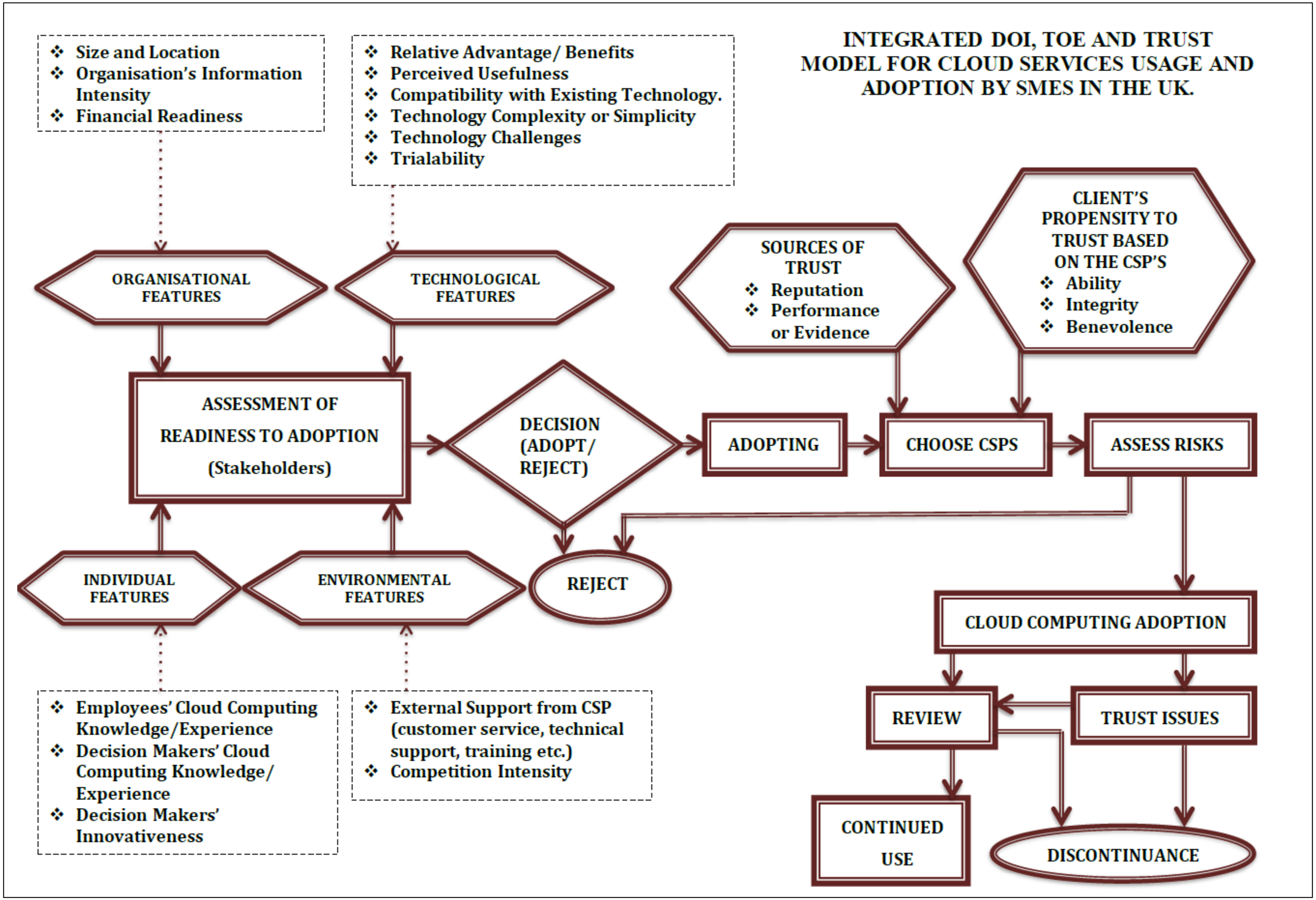

Figure 6: The Conceptual Model

In this model, the following variables were introduced to impact the usage and adoption of cloud computing by SMEs. Some of these variables originated from the DOI, TOE and IMOT models. Other variables considered suitable for the adoption of cloud computing by SMEs were also added. These have been discussed below.

- Relative advantage/Benefits (flexibility, scalability, reduced cost, efficiency etc.)
- Compatibility with existing technology
- Usefulness of cloud computing
- Technology complexity or simplicity (in terms of usage, maintenance and updates)
- Technology challenges (issues with security, privacy, availability, reliability, long-term contract lock-in, SLA etc.)
- Trialability
- Organisational size and location
- Organisational information intensity
- Organisational readiness/exposure (in terms of finance, other resource stability and exposure to information).
- External support from the CSP (customer service, technical support and training)
- Competition intensity
- Employees cloud computing knowledge/experience
- Decision makers' cloud computing knowledge/experience
- Decision makers' innovativeness (innovation tendency)
- Choice of CSP (based on clients' propensity to trust the CSP, reputation of the CSP and evidence from past work history).

These variable were considered to have direct influence on the clients' decision to adopt cloud computing. These variables are grouped into 5 main categories. As shown in figure 6 above, they are technological features, organisational features, environmental features, individual features and clients' propensity to trust the CSP. Apart from cloud computing, the variables introduced in this model may also influence the adoption decision of other innovations.

5.2 TECHNOLOGICAL FEATURES

According to Premkumar (2003), there have not been enough studies on the influence of technological features on the adoption of a technology. In this research, the variables grouped under the technological features are characteristics of cloud computing. Four of these features were adapted and modified based on Rogers' DOI and they are relative advantage (modified as benefits), compatibility with existing technology, technology complexity and trialability. The works done by Tan, et al. (2009) shows that relative advantage, complexity and compatibility had a positive influence on internet-based ICT adoption. In their work (Tehrani, 2013; Tornatzky and Klein, 1982) relative advantage, compatibility and technology challenges are innovation characteristics which have great influence on technology adoption.

Complexity or simplicity refers to the way in which an innovation is perceived to be difficult or easier to use (Rogers, 2003). This explains whether the innovation will be adopted or rejected. In previous research, complexity was found as an influential factor in the decision to adopt a technology (Alshamaila and Papagiannidis, 2013; Harindranath, et al., 2008). Compatibility on the other hand is the consistency of an innovation with previous or existing norms and values (Rogers, 2003). Compatibility in this research is seen as the extent to which cloud computing technology is compatible with the existing technical and environmental culture of the organisation.

Cloud computing challenges are those barriers that influence the adoption and usages of cloud computing by SMEs. In this research, cloud challenges have been discussed as those relating more to the cloud service provider and not necessarily the technology. These are contract lock-in, regulatory compliance, lack of privacy, lack of data integrity, SLA issues, loss of control of service, cost and difficulty of migration, lack of confidentiality of data etc.

Trialability is another important factor to consider in the decision to adopt cloud computing. For example, some big cloud providers (e.g. Microsoft) offer trial versions of the cloud services they provide to their customers. Rogers' trialability concept explains how easy an innovation can be tested before they can be used. A good number of researchers have found that trialability is one of the most influential factors on the adoption decision of a new technology (e.g. Hsbollah and Idris, 2009; Ramdani and Kawalek, 2007) In making an adoption decision on a new technology, a lot of re-invention may take place when running a trial version of that technology (Sahin, 2006). Depending on the experience gathered, this process may increase/decrease the adoption rate of the technology. It can also lower or speed up the decision process towards adoption. This factor is worthwhile to be investigated whether or not it has an influence in the adoption of cloud computing by SMEs. Therefore, it has been included in the model.

In addition, perceived usefulness and other technological challenges of cloud computing (issues with security, privacy, confidentiality, service availability, reliability, contract lock-in etc) as mentioned by previous researcher (Adedoyin, 2013; Sahandi, Alkhalil and Opara-Martins, 2013; Blumengthal, 2011) have also been included in this model. These variables could have an impact on clients' decision to adopt or continue to use cloud computing. Previous studies (refer to chapter 2) have mentioned that these challenges are barriers to the adoption and usage of cloud computing by SMEs. It would be necessary to investigate whether these challenges still exist and whether they have any significant influence the adoption of cloud computing by SMEs.

According to Davis, et al. (1989), perceived usefulness is the degree to which a person perceives that a specific technology would increase his or her job performance. In cloud computing, perceived usefulness is a variable which is thought to influence adoption. Apart from this, it is also thought that perceived usefulness of cloud computing can be influenced by trusting the service providers. In simple terms, cloud computing can be perceived as being useful if the clients trust in the ability, integrity and benevolence of their service providers. This research presents the opportunity to investigate the relationship between trust and perceived usefulness of cloud computing.

The DOI's variables excluded from this research are communication channels, types of innovation decisions, time, social system and the adopter categories (see figure 4). They were not included because the model is only highlighting the factors to consider before adopting cloud computing and not the entire stages of innovation acceptance. Their influence on the adoption of cloud computing can be investigated in further research. Also observability is not included because it is not considered applicable to the cloud computing context. Information relating cloud computing can be accessed through the World Wide Web, which is open to everyone at any time. For this reason, observability is not considered an influential factor in the decision to adopt cloud computing.

5.3 ORGANISATIONAL FEATURES

The second category is organisational features. The variables discussed under this category are organisational characteristics that may influence the organisations' decision to adopt cloud computing. These are organisational size and location, organisational information intensity and organisational readiness/exposure. Size of organisation was adapted from the TOE framework. Organisational readiness/exposure, location and information intensity were added as impacting factors on SME's decision to adopt cloud computing. Rogers (2003) mentioned that the size of an organisation determines the innovator's profile. According to Jeyaraj, et al. (2006), organisational size is one major impacting factor of technology adoption.

Many studies have investigated the influence of organisational size on ICT innovation adoption. Some of their empirical results found a negative correlation (e.g. Goode and Stevens, 2000), others found mixed correlation or not very clear result (e.g. Lee and Xia, 2006) while Tehrani, 2013; Belso-Martinez (2010) and Wang, et al. (2010) reported a positive correlation. Firm's size is a variable adapted from the TOE framework as part of its organisational features. In this research, firm size and location have been proposed as factors that influence the adoption and use of cloud computing by SMEs. Hence their inclusion in the model.

Information intensity is another factor. Tehrani and Shirazi (2014) described it as the degree to which reliable, updated, accurate and relevant information are present in an organisation whenever it needs it. Previous work (Wang, et al., 2010) proved that information intensity is a positive factor on the adoption of Radio Frequency Identification by SMEs. Information intensity is part of the TOE's organisational features adapted into this research model. This research proposes that SMEs in a more information-intense environment (whose core business functions depends on information) are more likely to adopt cloud computing.

Organisational readiness or exposure was also proposed to impact on clients' decision to adopt cloud computing. Organisational readiness/exposure could either be in terms of financial readiness, other resource stability and exposure to information. Awa, Ojiabo and Emecheta (2015) revealed that the extent of consumer readiness/exposure in the adoption of e-commerce proved to be an influential factor on SMEs' adoption decision. This variable was adapted from TOE's framework and seen as an influential factor on the adoption of cloud computing by SMEs.

5.4 ENVIRONMENTAL FEATURES

The third category is environmental features. The variables introduced in this category are external support from the CSP (customer service, technical support and training) and competition intensity. Due to the size and structure of SMEs, there is limitation on the amount of internal support they can get and as a result, they rely on external support. External support in this research are those technical supports, customer services or trainings provided by the

CSPs. This variable was adapted from the technology support variable under the environment feature of the TOE framework. It would be worthwhile to study if external support from CSPs would have any impact on client's decision to adopt cloud computing.

On the other hand, competition intensity explains whether the pressure from rival companies influences the decision to adopt a technology. Previous work (Zhu, et al., 2006) showed that competition intensity was an influential factor on the assimilation of e-business at the enterprise level. This variable was adapted from the TOE's industry characteristics and considered influential in SMEs' decision to adopt cloud computing.

5.5 INDIVIDUAL FEATURES

In this category, employees' cloud computing knowledge or experience, decision makers' cloud computing knowledge or experience and decision makers' innovativeness (innovation tendency) were proposed to play an important role in SMEs decision making process of cloud computing adoption.

As evidenced in the work of Thong (1999), employees' information systems knowledge had a positive influence on a company's decision to adopt information systems. This research proposes that those SMEs whose employees are cloud-computing aware or experienced with related technology, are more likely to adopt cloud computing. Decision maker's cloud computing knowledge or experience is another variable considered influential in the decision to adopt cloud computing.

The research carried out by Thong and Yap (1995) and Tehrani (2013) found that decision makers' knowledge about a technology or innovation has a positive influence on the adoption of that technology/innovation. In addition, decision makers are equivalent to change agents introduced by the DOI theory and in this research, decision makers within the SMEs are considered change agents. Therefore, studying whether their personal characteristics influence the adoption of cloud computing by SMEs has been considered in this research. This model also introduces the decision maker's innovativeness, the tendency of decision makers to try out innovations. This variable was adapted from Rogers' DOI.

5.6 CHOICE OF A CSP

The fifth category of the variables in the research model relates to clients' choice of a CSP in their decision to adopt cloud computing. This choice of a CSP has its variables as those factors to consider before making a decision on which CSP to use. First, the client may want to research about the reputation of particular CSPs and their performances via evidences from their work history. These variables are grouped under the sources of trust.

5.6.1 SOURCES OF TRUST

Trusting the CSPs can be derived from many sources even though they don't all come into play in all situations. From the general trust literature, the following outlines the important sources of trust with respect to this research.

5.6.1.1 REPUTATION-BASED TRUST

Reputation is a measure derived from direct or indirect knowledge of earlier interaction of peers, which can be used to access trust (Abawajy, 2011). An entity (a trustor) can trust another (a trustee) based on good reputation. In other words, reputation can be used to assess the level of trust of a trustee. Abawajy explained that reputation management plays an important role in developing cooperative relationships between users and service providers by lowering some risks. An individual that has high reputation is usually trusted in a society. This is very much applicable to the cloud system management by service providers.

As widely applied to e-commerce and P2P environments, reputation also plays an important role towards cloud adoption. In considering cloud adoption by SMEs, reputation of the service providers is very useful but not given much importance afterwards. When a user gains experience with a service, the trust placed on that service is usually assessed to meet the performance (ability) and reliability of the service provider, which evolved through that experience (Huang and Nicol, 2013).

5.6.1.2 EVIDENCE-RELATED TRUST

Evidence relates to the proof that an entity has about another before having trust on them. In cloud computing, evidence could be seen through the service provider's performance, competence, integrity, security and privacy, and benevolence (goodwill). Competence or performance is often considered in making trust judgments while integrity and benevolence (goodwill) are often neglected (Huang and Nicol, 2013). Huang and Nicol further explained that neglecting these two attributes implicitly assumes that trust does not depend on them or that dependency is satisfied if it does. As a result, it would be an interesting research challenge to characterise and quantify integrity and benevolence in making trust judgments.

As mentioned by Kautonen and Kohtamaki (2006), evidence based trust can sometimes be related to network-based trust. This is because when information circulates in networks and on reaching the trustor (clients), alters his knowledge of the trust situation. This affects the way the trustor grants or withholds trust. In this research context, evidence related source plays an important role because, any comment (negative or positive) posted in a cloud computing forum by previous clients of a particular CSP, can go a long way to encourage or discourage potential clients in taking up the services of that CSP.

A client might not have direct trust relationship with a service provider, but using the opinion of peers or past users can influence their intention towards cloud adoption or even continued usage. Another means of evidence-based trust in cloud computing could be seen through social network friends who have direct experiences with the service providers.

5.6.2 CLIENTS' PROPENSITY TO TRUST THE CSP.

According to McKnight, et al. (2002), propensity to trust is the extent to which an individual displays a tendency to be willing to trust or depend on others across broad spectrum of situations or persons. Propensity or willingness to trust roots back to personality psychology and it can be regarded as a stable intra-individual characteristic that influences interpersonal interactions with others (Grabner-Krauter and Faullant, 2008).

In the work of Mayer, Davis and Schoorman (1995), propensity to trust was defined as a stable within-party factor which can be regarded as a general willingness to trust others. In the past, a consumer's propensity to trust was found to have an influence on the consumer's initial trust on an online service provider (Teo and Liu, 2007; Gefen, 2000). In spite of its wide use in literature and other empirical studies, propensity to trust with respect to online consumer behaviour has not yet been investigated in depth (Grabner-Krauter and Faullant, 2008; McKnight, et .al, 2004). In this research, client's propensity to trust the CSP are based on the CPS's ability, integrity, benevolence (adapted from the IMOT). These factors are also regarded as the factors of perceived trustworthiness. This research proposes that the choice of a CSP should be made based on those factors.

After choosing a CSP, the next step is for the client to assess the risk involved then make a final decision whether to adopt or not. This research has not utilised all the variables from the original models. Only those considered suitable in the adoption process of cloud computing have been used.

5.7 EVALUATION OF LINKS BETWEEN VARIABLES IN THE CONCEPTUAL MODEL

The links between variables were evaluated. For example, the construct 'organisational features' (measured using size and location, information intensity and financial readiness) has a direct link to assessment of readiness to adoption, which has a direct link with decision to adopt or not adopt. Depending on how ready the client is following the assessment, adoption decision can be made. Similar links were established with the technological features, environmental features and individual features.

Clients' propensity to trust (based on ability, integrity and benevolence), has a direct link with the choice of CSPs, which has a direct link with assessment of risk. These steps determine the outcome of whether to adopt or not. There is no direct link to adoption because this study suggests that there are processes that must be followed to achieve adoption.

5.8 HYPOTHESIS DEVELOPMENT

The hypotheses for this study were developed using the proposed conceptual model, which was developed based on the TOE, DOI and IMOT frameworks. Previous studies have used the elements of the TOE and DOI frameworks to study the adoption of technology/innovation adoption at both the organisational and individual levels (see Tehrani and Shirazi, 2014; Amini, 2014, Al-Zoubi, 2013; Alshamaila, Papagiannidis and Li, 2013; Thong, 1999).

The TOE framework is an organisational-level theory and as explained in section 4.3, it incorporates technological, organisational and environmental aspects as the most important aspects of technology adoption. For the purpose of this research, the technology in discussion is cloud computing. The DOI theory has been used to study the adoption of innovating at both the organisational and individual level. While the IMOT model has been extensively used to study the concept of trust at an organisational setting.

Factors introduced by these three frameworks have been considered in formulating the hypothesis used in this research. These factors have been thought to influence cloud computing adoption and usefulness.

HYPOTHESIS 1

To a great extent, many researchers have examined the technological factors that influence the adoption of cloud computing, but with more interest in relative advantage and challenges. The challenges mainly discussed relate to security, privacy, compliance, availability of service, legal issues, internet access and automatic upgrade. Majority of these studies suggested how these issues can influence adoption. In order to promote consumers' confidence in cloud computing services and potentially promote greater adoption of the technology, the challenges that relate to the cloud service provider must be addressed (Brodkin, 2009). This will help achieve the public embracement of the technology in due time. With some deviations from previous research, it is thought that it would be worthwhile to re-investigate the influence of the awareness of cloud computing challenges on adoption, however, with a focus on those challenges that relate to the service provider and not just the technology itself. For example, long-term contract lock-in, lack of privacy, lack of data integrity, issue of migration between service providers, malicious insider within the provider's organisation etc. This lead to the development of hypothesis 1.

> ***HA1:*** *The higher the awareness of the challenges of cloud computing, the lesser the chances of cloud computing adoption.*

HYPOTHESIS 2

Following an extensive review of related literature, it was thought that knowledge level of cloud computing could be a significant factor that determines its adoption. As explained by Rogers (2003), having enough knowledge about an innovation is the first step in the adoption process. While many researchers have looked at the benefits and issues of cloud adoption, very little attention has been given specifically to the influence of knowledge level of cloud computing on cloud adoption. Although, in general information system adoption, Thong (1999) revealed that the knowledge of information systems has a positive influence on adoption.

The Eurostat 2014 survey on the use of cloud computing by enterprises in EU-28 countries, reported that insufficient knowledge or expertise influences the percentage of cloud computing usage by enterprise (see section 1.1). It also suggested that insufficient knowledge of cloud computing may limit the uptake of cloud computing by SMEs, however, they didn't consider the influence of knowledge on cloud computing adoption. In this study it would be worthwhile to find out whether knowledge level of cloud computing has an influence on its adoption. With a belief that companies with more knowledge of cloud computing are more likely to adopt cloud computing, hypothesis 2 was developed.

HA2: *The higher the knowledge about cloud computing, the higher the chances of cloud computing adoption.*

HYPOTHESIS 3

Inferences from recent literature suggest that different perspectives of challenges of cloud computing have been discussed. Many studies (e.g Aberer, et al., 2012; Khan and Malluhi, 2010; Pearson and Benameur, 2010) revealed the influence of these challenges on cloud adoption. These authors also suggested that these challenges (as mentioned above) could cause issues of trust in cloud service providers especially for those who are already using cloud services.

With an increase in the number of technology/online-supported transactions, which have replaced the traditional form of business interactions, the design for trust has become imperative for online customers (Riegelsbergal, et al., 2005). Since trust is an important factor for cloud computing adoption (see Pearson and Benameur, 2010), there is a need to address it from the perspective of those who are already using cloud computing.

In spite of the suggestions from previous studies, this study suggests that cloud computing adoption may not just be the issue but its perceived usefulness. Perceived usefulness could be informed by the trust that clients have on their service providers. Using the factors of perceived trustworthiness (introduced by the IMOT), the explanation of trust in this research context was given. Based on this understanding, hypothesis 3 was created to investigate the influence of trust on perceived usefulness of cloud computing (using only those who are already using cloud computing, who have CSPs).

HA3: *SMEs who trust their CSPs will more likely perceive cloud computing as being useful.*

5.9 CHAPTER SUMMARY

This model explains that for clients to consider the adoption of cloud computing, certain categories of variables should be considered. These variables impact on their decision to adopt or reject the technology. If after considering the factors and they decide to adopt, then they need to consider the choice of a CSP to use. This choice of a CSP is based on some other factors termed sources of trust and propensity to trust (Mayer, Davis and Schoorman, 2007; 1995). In this model, the client's sources of trust are based on the reputation of the CSPs and evidence from their service history while their propensity to trust the CSP is based on the CSP's ability, integrity, and benevolence. After considering these factors, the client decides to use a particular CSP over another then assesses the risks involved before the actual adoption. Even after adoption, the client can continue to review the process (post-adoption review) then decides whether to continue using the technology or discontinue if at any point trust is breached. This process is in line with Rogers' stages of innovation decision. Three hypothesis were deduced from the research model then tested. Please see chapters 6 and 7 for the research design, methodology and results.

CHAPTER 6

RESEARCH DESIGN, METHODOLOGY AND DATA COLLECTION

This sections describes the overall research design. It includes a brief review of research philosophies and a justification for the ones used in this study. It also presented the stages of the research design, sample and sample selection strategy, method and instrument of data collection, data and their measures, ethical process used in the research and the chapter summary.

6.1 RESEARCH DESIGN

Research design according to Clark and Creswell (2011) could be seen as procedures for collecting, analysing, interpreting and reporting data in research studies. Clark and Creswell further explained that research designs are useful because they help guide the methods decisions that researchers must make during their studies. According to Burns (2000), research design aims to minimise experimental errors thus increase the probability that an experiment will yield a reliable result. Research design explains the "notion of fitness for purpose" (Cohen, Manion and Morrison, 2000).

In essence, research design involves the choices the researcher makes in terms of the methodology and methods to be used to address the research questions. Research designs are often equated to the choice of research methods (eg. qualitative or quantitative research).

Every research design needs an underpinning philosophical considerations that should be decided before commencing the study. These philosophical considerations help the researcher to match the research purpose with the most appropriate methodology (Creswell, 2014).

There are two prominent philosophies – positivism and interpretivism. The key idea of the positivism paradigm is that reality is independent of the researcher and the social world exists externally; thus its properties can be measured through objective method instead of being subjective through sensation, intuition or reflection (Easterby-Smith, Thorpe and Jackson, 2015; Creswell, 2014). The positivism approach considers knowledge as that which is only based on experience and it can only be derived from strict scientific principles or methods (Blaike, 2009). Blaike further explained that positivists look forward to generate and prove theories. Under the positivism paradigm, researchers focus on predicting social behaviour through theories (Collis and Hussey, 2014). This means that theories permit the anticipation of social phenomena, provide the basis for the explanation and predict their occurrence. The positivism approach employs a deductive strategy of research in which the results are obtained through methods that can result in mathematical outcomes – quantitative surveys, simulation, laboratory experiments and collection of statistics from secondary sources (Bryman and Bell, 2007). Deductive strategy allows the researcher to establish hypothesis based on theories (Gill and Johnson, 2010). The results of quantitative methodology with positivism philosophy are definitive and repeated attempts of this type of research reflects similar results (Bryman and Bell, 2007).

According to Easterby-Smith, Thorpe and Jackson (2015), the interpretivism approach originated following certain criticisms of the positivism paradigm by philosophers. It sprung from the view that social reality is highly subjective and socially constructed. It is given meaning by our perceptions that the researcher actively interacts with that which is being researched, because it is not possible to separate what is in his mind and what exists from the social worlds (Creswell, 2014).

Bryman and Bell (2007) explained that interpretivism employs inductive strategy in which the results are obtained through methods that can result in qualitative textual, audio or visual results. Some examples of such methods are – focussed interviews, ethnography, phenomenography and action research. Interpreters look forward to explore new theories. These are part of qualitative methodology.

The difference between the positivism and interpretivism paradigms is that the positivism approach focuses on measuring social phenomenon while interpretivism aims to explore social phenomenon in order to gain interpretative understanding. The positivists adopt the quantitative methods while the intrepretivists use a range of methods that tend to describe, translate and come to terms with the meaning (qualitative) (Collis and Hussey, 2014). Similarly, the distinction drawn between qualitative and quantitative studies is based on a variety of theoretical considerations. The relationship between theory and research is often represented as a choice between a theory driven research and all its phases or theories as an outcome of the research process ((Bryman and Bell, 2015). This is often depicted as a choice between the deductive and inductive approaches

This research adopted the positivism philosophy and quantitative methodology. According to Aiken (1956), positivism approach provides the best means of investigating both social and human behaviour. It asserts that knowledge is only based on experience which can only be derived from strict scientific principles or methods; thus avoiding metaphysical speculations (Blaike, 2009). The positivism approach explains that knowledge is derived from a positive information and it can be scientifically verified (Collis and Hussey, 2014). In other words, Wallisman (2011) explained that in positivism approach, there is the possibility of providing logical or mathematical proof for every rationally justifiable assertion. Hence, the strategy for conducting this research is deductive. The steps involved in a deductive research are (a) development of theories (b) hypothesis (c) observation of data or information and (d) confirmation (Trochim, 2011). A quantitative research method aims to be more scientific and objective. In this method, different aspects of a phenomenon are quantified and measured (Blaike, 2009). It tries to identify cause and effect relationship in order to get the truth. Quantitative method is best for measuring the relationship between variables or concepts (eg. using correlation analysis) (Bryman, 2012). This means that any research involving the examination or investigation of the relationship between variables should be done using a quantitative method.

This research consisted of both primary and secondary data. Primary data is that collected using different research methods. Primary data is often more reliable because the researcher knows the source and follows the progression along (Gustafsson and Orrgren, 2012). According to Kelly (2005), primary data can be collected through one's own experiment, observation, surveys, interviews or logs.

Secondary data is regarded as that collected from an already existing data source. When compared to primary data, secondary data collection is cheaper but the reliability, validity and accuracy cannot be guaranteed (Gustafsson and Orrgren, 2012). The original source of the data is not known to the researcher and cannot be fully trusted. Kelly (2005) revealed that a secondary data is cheaper to collect and can be obtained through the following ways:

- Radio, television and internet sources
- Newspapers, Magazines and reviews.
- Research papers, Journal or articles.
- Story telling

To achieve the purpose of this research, the secondary part of the data was collected from recent publications (journals, articles, theses, books etc), and internet sources in this area of research. While the primary data was collected through an online survey (questionnaire).

Literature review in this area of study suggests that most studies relating the field of innovation acceptance carried out their data collection using surveys and interviews (Tornatzky and Klein, 1982). As stated by Newsted, Huff and Munro (1998), surveys are suitable for research involving technological innovations because

- They allow the researcher to determine the values and relationships between the factors that influence the adoption of technological innovations.
- They can easily be reused for providing an objective way of comparing responses.
- They can be generalised and used for predicting behaviours.
- It is less time consuming and less expensive (cheaper and quicker to administer)
- Several participants can also be surveyed within the allocated time of the survey
- Participants can choose a time best fit for them to respond.
- And finally the researcher's characteristics cannot influence the participants' replies (this eliminates bias in response).

Several studies in the field of technological innovations with concentration on cloud computing argued that survey is a useful instrument for collecting data (see KPMG, 2013; IDC, 2012; and Fujitsu, 2010). Based on this understanding, the survey method was considered a reasonably fit tool for carrying out this type of research (quantitative deductive research following the positivism philosophy). Online survey through the use of a questionnaire was chosen over the interview method after considering the nature of the research, the cost and time frame planned for carrying out the data collection.

6.1.1 RESEARCH DESIGN STAGES

The following figure represents the stages of this research.

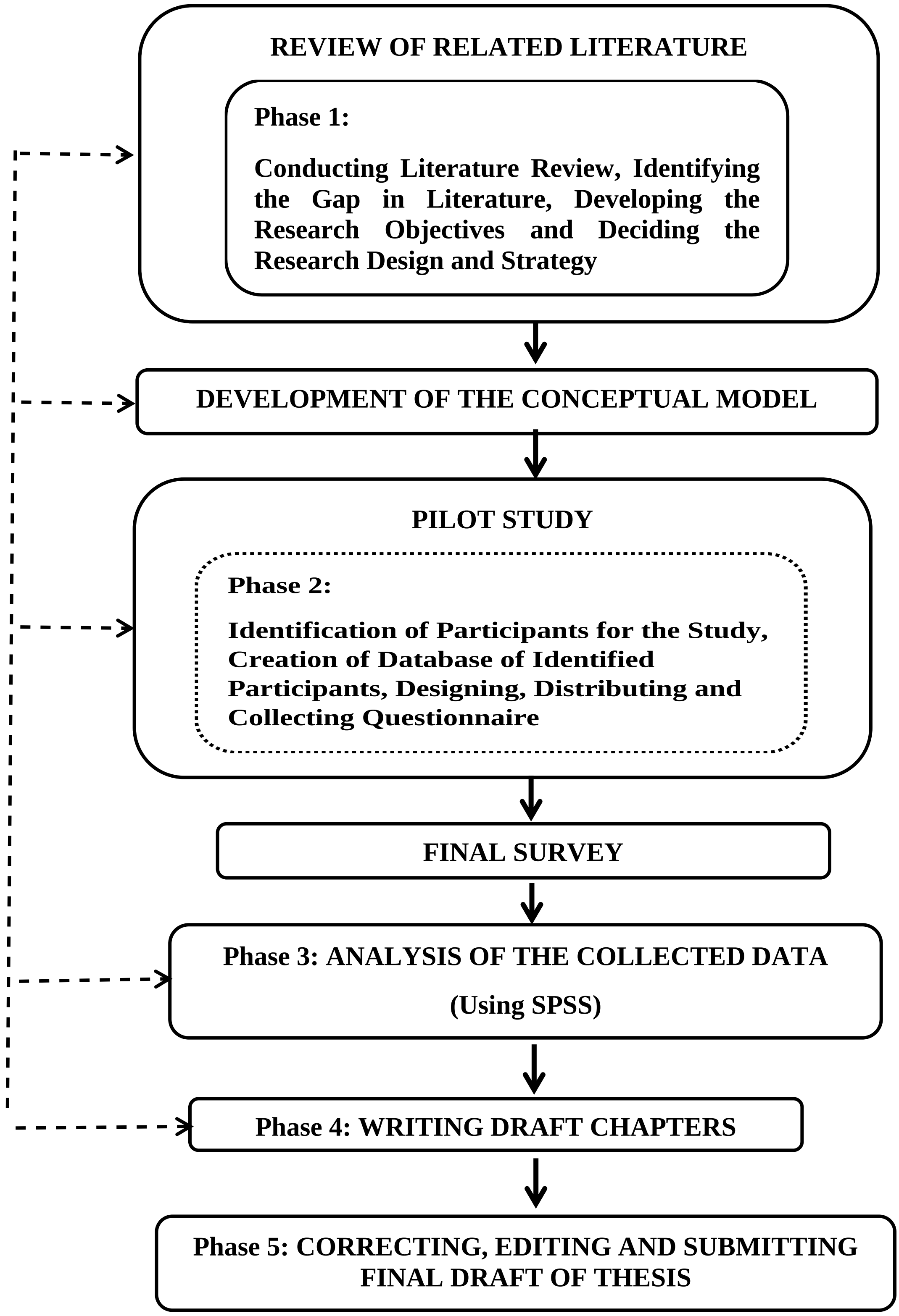

Figure 7: Research Design Stages

6.2 ETHICAL CONSIDERATION

Ethical concerns are very important when it comes to designing, conducting and evaluating research. Being aware of ethical issues relating to research involving the use of human subjects, this study presented a very minimal risk to the participants. Although, care was taken to ensure that the participants fully understood the nature of the study, their contribution to the study, the protection of their anonymity and confidentiality of their responses as well as their voluntariness to provide responses to the survey. The procedures on how to manage these risks were carefully explained in the full ethics application made to the university's Ethics Panel and an approval was given to carry out this research.

6.3 DATA AND MEASURES

The data collection method adopted for this research involved the design of an online survey through the use of a questionnaire. Details regarding the survey design, sampling procedure and participants used for the survey are given below.

6.3.1 DESIGN OF THE QUESTIONNAIRE

In order to provide measures for meeting the research objectives, a questionnaire consisting of 18 items was initially developed, reviewed and piloted. This was done to check for the understandability of the questions and further improvement on the design of the final survey. The final questionnaire consisted of 21 questions. Responses to majority of the survey items were captured using 5-point Likert-type scale with an additional option for I don't know. As understood, scales ranging from 5 to 7 points are less confusing and most commonly used in surveys (Dawes, 2008; Tehrani, 2013). Scales developed for this study ranged from strongly disagree/extremely unimportant to strongly agree/extremely important. With 1 assigned to strongly disagree/extremely unimportant and 5, strongly agree/extremely important.

Since all questions were made mandatory, providing the 'I don't know' option was a way of providing an option for the respondents where they lacked opinion on the subject, instead of just ticking any other options. This way, there would still be increased completion rate and decreased survey bias. The initial questionnaire consisted of the following questions (Please refer to the Appendix section for the full questionnaire).

- Questions 1 – 5 were filtering questions aimed at selecting the right participants for the survey. They consisted of questions such as the age confirmation of the participants, the organisational role of the participants, size of the company, the business sector that the company operates in, and the cloud computing knowledge level of the participants.

- Questions 6 and 7 consisted of participants' awareness of the benefits of cloud computing and their company's adoption status of cloud computing.
- Questions 8 was meant to check the participants' perception about the usefulness of cloud computing
- Question 9 was a Likert-scale type question highlighting possible challenges with cloud computing adoption as identified in previous studies (please refer to section 2.4). The participants responded whether they agreed or disagreed that these issues affected their decision to adopt cloud computing or are still concerns despite adoption.
- Question 10 was targeted at those participants who specified that their companies neither use nor plan to use cloud computing. It was related to specific issues affect or could affect their decision to adopt cloud computing.
- Question 11 concerned the length of years participants' companies have been using cloud computing. This question was only asked to participants whose companies have already adopted cloud computing.
- Question 12 consisted of the type of cloud service model currently used or intending to be used by the participants' organisation.
- Question 13 was a Likert-scale type question highlighting the benefits of cloud computing as identified in previous studies (please see section 2.3). The participants responded whether they agreed or disagreed on the highlighted benefits of cloud computing to their organisation.
- Question 14 was also a Likert-scale type question highlighting the factors considered by SMEs when making a decision to adopt cloud computing. The participants responded whether they agreed or disagreed on those factors.
- Question 15 used a Likert-scale to highlight the criteria for SMEs when making a choice for a service provider. The participants responded on the how important these criteria were in their consideration for a cloud service provider.

- Question 16 was asked for participants to describe their company in terms of the type and quantity of data they process, their IT usage, their size and location. This question was asked to determine whether these elements would have any influence on their decision to adopt cloud computing. The participants responded by defining whether they agreed or disagreed with the provided statements. This question was about organisational features.
- Question 17 was focused on the environmental features surrounding the participants' organisations. This was to determine whether their perceived external support from their service provider or competition intensity would have any influence on their decision to adopt cloud computing. The participants responded by defining whether they agreed or disagreed with the provided statements.
- Question 18 was about the individual features of employees and decision makers (IT managers, business owners etc.) within the participants' organisations. This had to do with their cloud-specific knowledge and innovativeness. The essence of this question was to determine whether these features would have any influence on the organisations' decision to adopt or continue to use cloud computing. The participants responded by defining whether they agreed or disagreed with the provided statements.
- Question 19 had to do with the level of experience of participants in terms of using cloud computing in their organisation.
- Question 20 (20.1 to 20.13) was asked to determine how well the integrity, ability and benevolence of the service providers measure the trust that their clients have on them. The participants of this question were from companies already using cloud computing, who already have experiences with service providers. Questions 20.1 – 20.4 were designed to measure integrity, 20.5 – 20.9 were designed to measure ability, 20.10 – 20.13 were measures of benevolence. Another set of questions were added to measure how the CSP was chosen (in terms of their reputation and the risks involved). These were questions 20.14 – 20.16.
- Question 21 was about the rating of participant's current trust level in their CSPs.

Please note that questions 16, 17, 18 and 20 were also Likert-Scale type questions.

6.3.2 PILOT STUDY

In order to improve the quality of the questionnaire, a pilot study was conducted. The questionnaire used for the pilot study consisted of 18 questions. The pilot survey was designed and launched online through one of the survey creation websites “smartsurvey.co.uk”. The sample used for the pilot study was 60 SMEs from different business sectors in the UK. It was made up of those who had adopted cloud computing, those planning to adopt, those thinking of adopting and those who had not adopted. These SMEs were randomly selected from an already existing directory of SMEs in the UK. These directories are the UK Business Forum (http://www.ukbusinessforum.co.uk/), a website for UK-based sole traders, freelancers, SMEs and Large Corporations; and 3 other UK SME groups in LinkedIn professional social network.

- UK SME’s Sharing and Collaborating
- 4BN.co.uk – Entrepreneurs, Small Businesses, Start-ups, SMEs.
- SME Business Growth Network – UK Only.

The pilot survey went live online on the 20th of July 2014. It was administered to key position holders such as IT managers, company directors and business owners of these companies. The first and last responses were collected on the 20th of July 2014 and the 20th of August 2014. Following a series of follow-ups and phone calls, a total of 46 responses were retrieved. Some basic analysis were done to check for relationships between variables and the way each question was answered by the respondents. No missing values were recorded since every question was made compulsory.

6.3.3 THE FINAL SURVEY

Following the pilot analysis, the questionnaire was restructured and reorganised. The survey questions were designed using all the features (variables) stated in the research’s conceptual model (chapter 5). Some filtering questions were initially formulated to make sure that only the targeted participants provided answers to the questionnaire. These filtering questions involved confirmation of age, job role, company size, sector and knowledge level of cloud computing. Based on these criteria other questions were asked to those participants who qualified to answer them (depending on their previous responses). These involved their perceptions about the benefits of cloud computing and their company’s current status of cloud computing adoption. The final set of questions were designed to suit different categories of respondents based on their company’s cloud computing adoption status. These set of questions involved the participants' opinions about some aspects of cloud computing and some features surrounding their companies (organisational, environment and individual/employee features).

Three questions were added to the initial pilot data. Two of the questions were specifically designed for those participants whose companies had already adopted cloud computing (questions 11 and 21). These included their number of years of using cloud computing (question 11) and the overall ratings of their trust level on their CSPs (question 21). These questions were added based on the feedback received during the pilot survey. Some of the participants explained that the trust they had on their service providers either increased or decreased with the number of years they had used cloud computing. Due to the fact that the pilot questionnaire did contain a question that relate to the number of years of experience and the overall trust rating of the CSPs, it was thought that adding these two questions could be valuable with the hope of checking whether trust in CSPs decrease or increase with years of cloud computing usage.

The last question added after the pilot study was directed at those participants whose companies were neither using nor planning to use cloud computing (question 10). This aimed at assessing the main factors hindering their decision to adopt cloud computing. The reason for adding this question was also based on the feedback received from the pilot study participants. A bias was initially created by assuming that those neither using nor planning to use cloud computing was due to trust issue alone. The feedback received explained that there are other issues (such as company size, location, financial constrain, issue of compatibility with existing infrastructure) which are affecting their decision to adopt cloud computing. These changes helped in eliminating bias.

Following these changes, the survey was redesigned on the Smartsurvey website. This design involved the use of question skipping to suit the participants whose companies were:

- Already using cloud computing. This category answered all questions
- Planning of using cloud computing. This category answered questions 1 to 9, skipped 10 and 11, answered 12 to 18 and skipped 19 to 21.
- Thinking of using cloud computing. This category answered questions 1 to 9, skipped 10 and 11, answered 12 to 18 and skipped 19 to 21.
- Neither using nor plan to use cloud computing: Answered questions 1 to 10 then skipped the rest questions.

6.3.4 THE SURVEY PARTICIPANTS

The survey was administered to SMEs in the UK. Previous studies on this area administered their survey to SMEs in general and in specific locations such as the entire Europe, America, Australia and Ireland (Carcary, Doherty and Conway, 2015, Carcary, 2014 and Tehrani, 2013). Literature review in this area suggests that not very much research has been done regarding the adoption of cloud computing by UK SMEs. Based on this understanding, SMEs in the UK were employed to take part in the survey because they were the focus of this research. In order to have a representative sample of SMEs in the UK, the survey was conducted using known databases consisting of UK SMEs. These databases contained valuable information about the background of the firm (e.g business sectors and activities), phone numbers, email addresses, names of the business owners, CEOs or directors. These directories were found to be the appropriate sampling frame from which SMEs could be contacted. The sample frame was stratified into the four part of the United Kingdom. These are England, Scotland, Wales and Northern Ireland. The following sources provided the directories of SMEs from these four regions.

- Appointnments.thethursdaytimes.co.uk (for database of SMEs in England).
- Scotweb.com (for database of SMEs in Scotland).
- Walesonline.co.uk (for database of SMEs in Wales)
- Gb.compass.com (for database of SMEs in Northern Ireland).

Using these databases, the email addresses were chosen as the primary contact since almost all the SMEs email addresses were given. A list was compiled with 300 SMEs randomly selected from each database, thus making a total sample of 1200. This number was chosen as literature in this area suggests, to meet the 1-month time frame for the survey and to ensure manageability in terms of follow-ups. The selection was done using Microsoft Excel Random Number Generator.

The email sent to respondents consisted of participant's information/consent form and a link to the web survey. The survey went live online on the 12th of March 2015. The first and last responses were collected on the 14th of March 2015 and the 14th of April 2015. Following a series of follow-up emails and a reminder note which contained the survey link, a total of 269 completed responses were retrieved with additional 12 incomplete responses. The incomplete responses were removed because they were considered invalid. The 269 responses received represent a response rate of 22.4%.

According to Dillman (2007), there is no rule as to what response rate is needed for a particular study. This author explained that response rates can be influenced by so many factors, for example, respondents' perception about the importance of the subject area, attractiveness of the survey and method of survey distribution. The response rate of this research had some sort of improvement compared to studies of similar scale (Tehrani, 2013 (20%); Low, Chen and Wu, 2011 (22.22%); Oliveira and Martins, 2010 (13.1%); and Zhu and Kreamer, 2005 (13%)). The table below represents the survey sample characteristics.

RESPONDENTS' JOB ROLE	Observation	(%)
IT Manager	38	14.45
Network Manager	35	13.31
IT Director	21	7.98
Chief Information Officer	29	11.03
Company Director	28	10.65
Business Owner	93	35.36
Others	19	7.22
Total	263	100
COMPANY SIZE (NUMBER OF EMPLOYEES)		
1- 9 Employees	53	20.15
10 – 49 Employees	106	40.30
50 – 249 Employees	84	31.94
250+ Employees	19	7.22
I don't know	1	0.38

Total	263	100
BUSINESS SECTOR		
Accounting and Finance	39	16.05
Manufacturing	18	7.41
Information Communication Technology	49	20.16
Retail	28	11.52
Transport	18	7.41
Construction	12	4.94
Health and Social Care	15	6.17
Insurance	13	5.35
Hotel, Travel and Leisure	15	6.17
Real Estate	5	2.06
Music, Art and Entertainment	8	3.29
Food and Drink	10	4.12
Education	12	4.94
Others	1	0.41
Total	243	100
CLOUD COMPUTING ADOPTION STATUS		
I don’t know.	9	4.15

My Company Neither Uses nor Plans to Use Cloud Computing Services.	46	21.20
My Company is Thinking of Using Cloud Service in the Future.	33	15.21
My Company is Planning to Use Cloud Service.	27	12.44
My Company is Using Cloud Service.	102	47
Total	217	100

Table 5: Survey Sample Characteristics

As seen on the table above, majority of the eligible respondents were individuals who were in position to talk about the overall activities of their respective companies. They were Chief Information Officers, Business Owners, Network Managers, IT Directors and Company Directors. These job positions suggest that the data source was of good quality. The distribution using company size, measured by no of employees, represented the selection criteria for small and medium enterprises, which was the focus of the study. Those who indicated 250+ employees and I don't know responses were automatically removed from continuing the survey.

As evident in the table above, majority of the respondents came from business sectors such as Information Communication Technology (49%), Accounting and Finance (39%), Retail (28%), Manufacturing (18%) and Transport (18%). Again, majority of the respondents were those whose companies had already adopted cloud computing.

6.3.5 CONTROLLING AND EXAMINING POTENTIAL BIASES

During the design stage of the questionnaire, the guidelines recommended by Podsakoff, et al. (2003) were used to avoid common method bias. In this regards, questions were designed using different scale types. Measurement items including those of the dependent and independent variables were adapted from published works (see section 6.3.6). Survey questions were designed by considering the time of completion. The following were also considered in designing the survey questions.

- Utilising non-technical wording of questions
- Ensuring the confidentiality of respondents
- Maximising the response options available and not constraining the participants to certain response option. There was an inclusion of the ‘I don’t know’ option.
- Questions were a mix of rating scales.

Following data collection, the two major biases (non-response and common method) were examined. Non-response bias occurs when there is a systematic difference between respondents and non-respondents of a survey. If there is a presence of any systematic differences between these two groups, then the representativeness of the survey is questioned. To achieve a representative sample, the main aim is to minimise non-response bias (Armstrong and Overton, 2005). To estimate non-response bias in a study, Rogelberg and Stanton (2007) suggested the following techniques.

S/N	**TECHNIQUE**	**DESCRIPTION**
1	Passive Non-Response Analysis	Examine the relationship between passive nonresponse characteristics and standing on the key survey topics being assessed.
2	Wave Analysis	Compare late respondents to early respondents.
3	Archival Analysis	Compare respondents to non-respondents on variables contained in an archival database.
4	Follow-up Approach	Resurvey Non-Respondents.
5	Interest-level Analysis	Assess the relationship between interest in the survey topic in question and standing on the key survey topics being assessed.
6	Benchmark Analysis	Use measures with known measurement properties and normative data so that observed data can be cross-referenced.
6	Demonstrate Generalizability	Replicate findings through the use of different set of research methods.
7	Active Non-Response Analysis	Assess percentage of intentional, purposeful and a priori nonresponse using interviews.
8	Worst-case Resistance	Use simulated data to determine robustness of observed findings and relationships.

Table 6: Techniques for Estimating Non-Response Bias (Rogelberg and Stanton, 2007).

To assess any potential non-response bias, this research employed the wave analysis technique to compare the responses of early and late respondents. Compared to any other methods, wave analysis is widely used (Atif, Richards and Bilgin, 2012), less time consuming and coherent with the study. In this regard, wave means responses generated by stimuli. Example of such stimuli could be a follow-up email or a reminder. Participants who responded in the later waves responded with increased stimulus (Atif, Richards and Bilgin, 2012). It is assumed that the answers provided by late responders are quite similar to non-responders because they share similar characteristics (Armstrong and Overton, 2005).

The dataset was divided into two waves (parts). Those in wave 1 were those who responded within the first two weeks, and those who responded in the last two weeks after sending a reminder email were in wave 2. The questionnaire in each mailing periods contained exactly the same questions. The outcome measure of this study was predicting adoption and perceived usefulness of cloud computing. Questionnaire responses received before and after sending a reminder were compared based on three variables. These variables were company size, knowledge level of cloud computing and cloud computing adoption status. Differences in the waves (1 and 2) were analysed using Chi-square test to estimate the statistical significance. A p-value less than or equal to 0.05 was considered statistically significant.

	Early Responders (Wave 1)		**Late Responders (Wave 2)**	
	Wave 1 (N)	**% of Wave 1**	**Wave 2 (N)**	**% of Wave 2**
Company Size				
1 – 9 Employees	26	49.1	27	50.9
10 – 49 Employees	34	31.8	73	68.2
50 – 249 Employees	29	34.5	55	65.5
250+ Employees	8	42.1	11	57.9
Total (N = 263)	97		166	
Knowledge Level of Cloud Computing				
I have no knowledge of cloud computing	8	30.8	18	69.2
I have little knowledge of cloud computing	16	41.0	23	59.0
I have some knowledge of cloud computing	23	34.3	44	65.7

I have good fundamental knowledge of cloud computing	24	33.8	47	66.2
I am expert in cloud computing	17	42.5	23	57.5
Total (N = 243)	88		155	
Cloud Computing Adoption Status				
My company neither uses nor plans to use cloud computing	17	34.4	31	64.6
My company is thinking of using cloud computing	16	43.2	21	56.8
My company is planning to use cloud computing	11	40.7	16	59.3
My company is using cloud computing	36	34.0	70	66.0
Total (N = 218)	80		138	

Table 7: Comparison of Early and Late Respondents.

From the Chi-square test, no statistically significant difference was found between early and late responders regarding their responses in Company Size (*Chi-square = 4.996, degree of freedom = 3, p =.172*), Knowledge Level of Cloud Computing (*Chi-square = 1.691, degree of freedom = 3, p = .792*) and Cloud Computing Adoption Status (*Chi-square = 1.248, degree of freedom = 3, p = .742*). Based on the p-values, this study reveals that the early and late responders in the research survey were not statistically significant different from each other. As a result, it can be concluded that non-response bias was not a major concern in this study.

Common method bias is a type of bias which occurs when a researcher uses a single survey respondent as a source for both dependent and independent data using one instrument. In this study, common method bias was examined using Harman's single-factor test (Podsakoff, et al., 2003). By running an exploratory factor analysis with unrotated principal component factor solution, the largest factor explains 35.6% variance out of 64 measured variables. Therefore, it can be concluded that no significant common method bias was found in this study (since the cut-off point was less than 50%).

6.3.6 DEFINITIONS AND MEASUREMENTS OF ALL VARIABLES IN THE CONCEPTUAL MODEL

Based on a comprehensive review of related literature, measurement items were developed and reframed to suit the research context. Operationalisations already tested by previous studies (e.g. Tehrani, 2013; Colquitt, et al., 2007; Chau and Hui, 2001; Mayer, et al., 1999) were utilised as much as possible. In addition to these, other items such as organisational readiness/exposure, company location, criteria for choosing CSPs, Reputation of the CSP, evidence from CSP's work history etc. were developed as they were deemed appropriate for meeting the research objectives. These self-developed measures were used only when suitable established measures were not available and they were developed using appropriate literature (for example Tehrani and Shirazi, 2014). The table below shows the original definition of the variables in the research model, their original measures and all subsequent adaptations.

CONSTRUCTS	**DEFINITIONS**	**MY ADAPTATIONS**
TECHNOLOGICAL VARIABLES		
Relative Advantage/Benefits	Refers to: "the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2003, p. 229)	
Perceived Usefulness	This was defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" Davis (1989).	
Compatibility with Existing Technology	Refers to: "the degree to which an innovation is perceived	

	as consistent with the existing values, past experiences, and the needs of potential adopters" (Rogers, 2003, p. 240)	
Technology Complexity/Simplicity	Refers to: "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 2003, p. 257)	
Technology Challenges	These were defined in terms of issues relating to security, privacy, confidentiality, service availability, reliability and contract lock-in (Sahandi, Alkhalil and Opara-Martins, 2013; Blumenthal, 2011)	These were grouped together as cloud computing technology challenges and defined as barriers to cloud adoption.
Trialability	Refers to: "The degree to which an innovation may be experimented on a limited basis" (Rogers, 2003, p. 258)	
ORGANISATIONAL VARIABLES		

Size and Location	Defined as ‘the number of employees within an organization’ (Oliveira and Martins, 2011)	Location was added to complement size and it is defined as the geographical place where the company exists.
Organisation’s Information Intensity	The degree to which information is present in the products or services of a business, reflects the level of information intensity of those products or services (Thong, 1999, p.196)	
Financial Readiness/Exposure	This variable was modified using Awa, Ojiabor and Emecheta (2015) consumer readiness, which was defined as potential market volume, consumers’ understanding of the applications, and the associated pay-offs.	This study describes organisational readiness/exposure in terms of financial readiness, resource stability and exposure to information.
ENVIRONMENTAL VARIABLES		
External Support from CSP (Customer Service, Technical Support, Training etc.)	External support is defined as the perceived level of supports offered by cloud providers (Training, customer service and technical	

	support) (Tehrani and Shirazi, 2014)	
Competition Intensity	Competition intensity is defined as “the degree that the company is affected by competitors in the market” (Zhu, et al., 2004, p. 24).	
INDIVIDUAL VARIABLES		
Employees’ Cloud Computing Knowledge/Experience	Refers to the employees’ knowledge about cloud computing (based on decision makers’ opinion) (Tehrani, 2013)	
Decision Makers’ Cloud Computing Knowledge/Experience	Refers to the decision Makers’ knowledge about cloud computing (various aspects of cloud computing) (Tehrani, 2013)	
Decision Makers’ Innovativeness	Refers to the level of Decision makers’ preference to try solutions that have not been tried out, which are therefore risky (Tehrani and Shirazi, 2014)	
SOURCES OF TRUST		

Reputation	Abawajy (2011) described reputation as a measure derived from direct and indirect knowledge of earlier interaction of peers, which can be used to access trust.	This was added into the model and in the context of the research, reputation is defined as the opinion generally held about a CSP in terms if his level of integrity and expertise.
Performance/Evidence		This was explained in this research as the proof that a CSP has regarding his level of expertise and integrity. And evidence could be seen through the CSP's performances from his past work history.
CLIENTS' PROPENSITY TO TRUST		
Ability	Ability refers to the group of skills, competencies, and characteristics that enable a party to have influence within some specific domain (Mayer, Davis and Schoorman, 1995).	
Integrity	Integrity is defined 'as the extent to which a trustee is believed to adhere to sound moral and ethical principles, with synonyms including *fairness*,	

	justice, *consistency*, and *promise fulfilment*' (Colquitt, et al., 2007)	
Benevolence	Benevolence is the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive (Mayer, Davis and Schoorman, 1995)	
VARIABLE MEASURES		
CONSTRUCTS	**ORIGINAL MEASURES**	**MY ADAPTATIONS**
TECHNOLOGICAL VARIABLES		
Relative Advantage/Benefits		Measured using perceived benefits of cloud computing. These measures were self-developed using the works of Tehrani and Shirazi (2014) and Thong (1999)
Perceived Usefulness		Measured using questions that relate to clients' perception about the usefulness of cloud computing. These measures were self-developed because no suitable established measure was available. The measures were developed using the work of Davis, et al. (1989).

Compatibility with Existing Technology		Measures were self-developed using the work of Tehrani (2013)
Technology Complexity/Simplicity	Measured using the work of Tehrani (2013)	
Technology Challenges	Adapted and amended the measures used by Sahandi, Alkhalil and Opara-Martins (2013), Cloud Industry Forum (2011) and ENISA (2010)	
Trialability		Self-developed measures using the work of Tehrani and Shirazi (2014), Hsbollah and Idris (2009) and Ramdani and Kawalek (2007).
ORGANISATIONAL VARIABLES		
Company Size	Measured using number of employees, which were selected based on EU criteria of less than 250 employees for SMEs (ENISA, 2010; EU-Commission, 2003)	

Organisation's Information Intensity	Items measuring information intensity were adapted and amended using the work of Tehrani (2013)	
Financial Readiness/Exposure		Self-developed measures were created using the works of Oliveira and Martins (2011; 2010)
ENVIRONMENTAL VARIABLES		
External Support from CSP (Customer Service, Technical Support, Training etc.)	Adapted from the work of Tehrani (2013), with the questions rephrased a little	Amended the scales from extremely important to strongly agree
Competition Intensity		Self-developed measures using the works of Alshamaila and Papagiannidis (2013) and Tehrani (2013)
INDIVIDUAL VARIABLES		
Employees' Cloud Computing Knowledge/Experience		Measures were self-developed using the works of Thong (1999) and Tehrani and Shirazi (2014)
Decision Makers' Cloud Computing Knowledge/Experience		Measures were self-developed using the works of Tehrani (2013) and Thong (1999).
Decision Makers' Innovativeness	Adapted from the work of Tehrani (2013)	
SOURCES OF TRUST		

Reputation		Measures were self-developed using the works of Abawajy (2011).
Performance/Evidence		Measures were created using the works of Huang and Nicol (2013) and Kautonen and Kohtamari (2006)
CLIENTS' PROPENSITY TO TRUST		
Ability	Measures used for these 3 trust dimensions were adapted from the work of Colquitt, et al. (2007), who adapted the survey items used by Mayer and Davis (1999); and Mayer, Davis and Schoorman (1995)	
Integrity		
Benevolence		

Table 8: Original Definitions and Measures of Construct and Subsequent Adaptations.

6.3.7 DESCRIPTION AND MEASURES OF VARIABLES USED IN THE ANALYSIS.

To ensure that the survey targeted the correct respondents for the study (SMEs), question 3 was designed. This question was about company size and measured using number of employees. SMEs were selected based on the EU criteria of less than 250 employees (EU-Commission, 2003).

In terms of selecting the survey respondents, variable 7 was designed. This was categorised into five groups so as to check the current status of cloud computing adoption by the respondents' organisations. This question was formulated based on Rogers' (2003) innovation adopter categories. These categories consisted of those SMEs

- Using cloud computing

- Thinking of using cloud computing
- Planning to use cloud computing
- Neither using nor plan to use cloud computing.
- Not familiar with cloud computing

Pro-adoption or pro-innovation bias is an underpinning that a new technology or innovation should be adopted or diffused by every member of the social system (Rogers, 2003). To overcome pro-adoption bias (as suggested by Rogers), the last two categories were included).

As seen in the table above, items measuring technological features (relative advantage, compatibility with existing infrastructure, complexity and trialability) were adapted from the works of Thong (1999); Tan, et al. (2009); and Alshmaila and Papagiannidis (2013). Thong (1999) investigated the adoption of information systems by small businesses. Tan, et al. (2009) investigated the adoption of internet-based ICT by SMEs in Malaysia while Alshmaila and Papagiannidis (2013) studied these variables while trying to describe the adoption process of cloud computing by SMEs in North East of England.

Another variable specified under the technological features was technological challenges. This has to do with issues or barriers to cloud adoption as specified in previous studies (please refer to chapter 2). Items measuring the challenges of cloud computing were questions 9.1 to 9.11.

With the help of related literature on barriers to cloud adoption, item 10 was created. This was designed for non-adopters of cloud computing. This question was tailored to assess the reasons behind their non-adoption of cloud computing.

Question 13 contained 8 different items in a scale which were created to measure the benefits of cloud computing. These items were adapted from the works of Tehrani (2013).

With the help of related literature, questions 14 and 15 were added to the questionnaire because they were deemed appropriate for the research context. Question 14 consisted of 4 items, which were intended to measure the factors considered in the decision process of cloud computing adoption. Question 15 contained 10 different items and it was created specifically for this research. Its purpose in the questionnaire was to measure the factors to consider when choosing a cloud service provider.

In order to measure organisational features surrounding the respondents' companies, question 16 was created. Organisational features in this context are features such as company size and location, organisational information intensity and organisational readiness/exposure. Four items were developed to measure organisational features. The first and second item were used to measure information intensity. The third item was used to measure organisational readiness/exposure and the fourth was used to measure the size of the company. Company size was measured using number of employees. This is a popular measure employed by researchers of small, medium and large businesses (please see Cragg and King, 1993; Zhu and Kraemer, 2005; Sahandi, et al., 2012 and KPMG, 2014). Items measuring size and information intensity were adapted from the works of Wang, et al. (2010) and Tehrani (2013). Wang, et al. investigated the adoption of Radio Frequency Identification (RFIS) by manufacturing firms in Taiwan, while Tehrani investigated the factors influencing the adoption of cloud computing by North American SMEs. Location and organizational readiness/exposure were added to examine if they would have impact on SMEs decision to adopt cloud computing.

Items measuring environmental features in the survey were specified under question 17. Here, 5 items were developed to measure two major components of environmental features, which were external support from CSPs (customer service, training and technical support) and competition intensity. The first 3 items were used to measure external support while the 4th and 5th items were used to measure competition intensity. Items measuring external support were adapted from the work of Tehrani and Shirazi (2014) while those measuring competition intensity were adapted from the work of Zhu, et al. (2006). Zhu, et al. used a technology diffusion process to investigate the process of assimilating innovations by firms in different countries.

Items specified under question 18 were those measuring individual features. Components making up individual features were the employees' cloud computing knowledge/experience, decision makers' cloud knowledge/experience and decision makers' innovativeness. Here, six items were developed to measure these components. Item 1 was used to measure employees' cloud computing knowledge/experience, items 2 and 3 were used to measure decision makers' cloud computing knowledge/ experience while items 4, 5 and 6 were used to measure decision makers' innovativeness.

Employees' cloud computing knowledge was not measured directly instead the survey respondents which were mostly decision makers, rated their employees cloud computing knowledge and experience. Items measuring employees cloud knowledge/experience and decision makers' innovativeness were adapted from the work of Thong (1999) and Tehrani (2013). Items used to measure decision makers' innovativeness were adapted from the work of

Thong and Yap (1995). Thong and Yap investigated the adoption of information systems by small businesses using CEO and organizational characteristics.

In order to measure the trust rating of CSPs (using dimensions such as ability, integrity and benevolence), question 20.1 to 20.13 were created. Even though question 20 consisted of 16 questions, only 13 questions were used to measure trust in ability, integrity and benevolence. The remaining items (20.14 to 20.16) were used to measure reputation of the CSPs and risks involved in choosing the CSPs. Item 20.1 to 20.4 were used to measure integrity, items 20.5 to 20.9 were used to measure ability while items 20.10 to 20.13 were used to measure benevolence. Items in this scale were adapted from the work of Colquitt, et al. (2007). This work investigated the unique relationship between trust, trustworthiness and trust propensity with risk taking and job performance. Colquitt, et al. adapted the Mayer, Davis and Schoorman (1995) conceptual model variables and Mayer and Davis (1999) trust propensity scale items. Using the works of Mayer, Davis and Schoorman and Colquitt et al. as a guideline, variables were grouped under

- Ability if they captured cloud service providers' competence and skills
- Integrity if they captured clients' (SMEs) perception that the service providers adhere to a set of principles which they find acceptable.
- Benevolence if they captured the extent to which the CSPs are believed to want to do good to their client without any motive of making profit.

The items measuring reputation and risk taking were those included in the study to capture how the clients chose their CSPs and any associated risks taken. With the help of the work of Abawajy (2011), items measuring reputation and risk was designed.

6.3.7.1 DEPENDENT VARIABLES

This study consisted of two dependent variables used in two different parts of the data analysis (detailed below). The first dependent variable of this research was the adoption status of cloud computing. Adoption status in this regard is the position of the respondent's company with respect to cloud computing adoption. There were 4 measures of this dependent variable. The first measure were those companies already using cloud computing.

The second were those planning to use cloud computing. The third measure consisted of those companies thinking of using cloud computing while the last were those companies that neither using nor planning to use cloud computing. The distinction between those planning to using cloud computing and those thinking of using cloud computing is that those planning of using cloud computing have already decided on the service model of cloud computing they want, and have started planning the process of adoption. But those thinking of using cloud computing may not have known the type of cloud computing model they want but have the interest of adopting cloud computing in future.

The second dependent variable was the perceived usefulness of cloud computing. This variable was designed to measure the respondents' perception about the usefulness of cloud computing. It was made up of four measures. These measures are: cloud computing is very useful, cloud computing is useful, cloud computing is less useful and cloud computing is not useful.

6.3.7.2 INDEPENDENT VARIABLES

These variables were those proposed to have some influence on the dependent variable. The independent variables used in this study are given below:

- Respondents' Knowledge Level of Cloud Computing
- Challenges of Cloud Computing Adoption
- Respondents' Trust on their Service Providers (measured using Mayer, Davis and Schoorman's factors of perceived trustworthiness (ability, integrity and benevolence)).

The first variable represented the participants' knowledge level of cloud computing. The second variable relates to the issues of cloud computing adoption. The third variable was related to the perceived usefulness of cloud computing while the last item was about the respondent's trust rating of their CSPs.

6.3.7.3 CONTROL VARIABLES

- Company Size
- Perceived Benefits of Cloud Computing
- Perceived Usefulness of Cloud Computing
- Reliability of the cloud service provider.

The first item was developed to ensure that the survey targeted the right audience for the study. The other three items were developed to ask the respondents about their perception of the benefits of cloud computing, usefulness of cloud computing and whether reliability was an important criterion for choosing their CSPs.

A tabular description of all variables used for the analysis has been given below.

Variable	Description
Adoption Status	An ordinal variable denoting the adoption status of the respondents' company. Value was assigned (1) if the company was neither using nor planning to use cloud computing, (2) if the company was thinking of using cloud computing, (3) if the company was planning to use cloud computing and (4) if the company was already using cloud computing.
Company Size	An ordinal variable developed to sample the right respondents for the study. It was measured using number of employees in the respondent's company. Value was assigned (1) for 1 – 9 employees, (2) for 10 – 49 employees, (3) for 50 – 249 employees and 4 for 250+ employees.
Knowledge Level of Cloud Computing	An ordinal variable intending to measure the respondent's knowledge level of cloud computing. Value (1) was assigned if the respondent had no knowledge of cloud computing, (2) for respondent with little knowledge of cloud computing, (3) for respondent with some knowledge of cloud computing, (4) for respondents with good fundamental knowledge of cloud computing and (5) for those who are experts in cloud computing.
Perceived Benefits of Cloud Computing	This is an ordinal variable used to measure the respondents' perception about the benefits of cloud computing. Value (1) was assigned to "no, not beneficial", (2) "yes, less beneficial, (3) "yes, beneficial" and (4) "yes, very beneficial".
Perceived Usefulness of Cloud Computing	An ordinal variable designed to measure the respondents' perception about the usefulness of cloud computing. Value (1) was assigned if the respondents perceived cloud computing as not useful, (2) was assigned if they perceived cloud computing as less useful, (3) was assigned to if they perceived cloud computing as useful and (4) was assigned if they perceived cloud computing as very useful.

Challenges of Cloud Computing	This variable was a multi-scale ordinal variable designed to measure the challenges of cloud computing. It consisted of 11 variables in a scale. These were regulatory compliance, cost and difficulty of migration, lack of privacy, lack of availability of service/data, lack of confidentiality of data, lack of data integrity, lack of liability of providers in case of security incidence, loss of control of service, malicious insider within the provider's organisation, service level agreement issues, and CSP's contract lock-in. Value was assigned (1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree and (5) strongly agree.
Reliability of the Service Provider	An ordinal variable denoting the respondent's opinion whether reliability was an important criterion for choosing their service provider. Value was assigned (1) if respondents indicated extremely unimportant, (2) if they indicated unimportant, (3) if they indicated neither important nor unimportant, (4) if they indicated important and (5) if they indicated extremely important.
Trust rating of Cloud Service Providers	This variable was designed to measure the respondents trust level on their CSPs. It consisted of multi-scale items with three dimensions of ability, integrity and benevolence. The first four item were designed to measure integrity. Items 5 to 9 measured ability while items 10 to 13 measured benevolence. Value was assigned 1 if the respondents indicated strongly disagree, (2) if they indicated disagree, (3) if they indicated neither agree nor disagree, (4) if they indicated agree and (5) if they indicated strongly agree.

Table 9: Description of Variables used for Data Analysis

6.3.8 THE MEASUREMENT MODEL USED IN THE RESEARCH

In the social research and many other research areas, variables (often ordinal) are analysed with the aim of identifying one or more latent constructs or simply to concisely represent the phenomenon under investigation. Latent constructs are theoretical in nature. This means that they cannot be directly observed and, as such, cannot be directly measured. To measure a latent construct, researchers capture indicators (observed variables) that represent the underlying construct (Garger, 2011).

In order to assess latent constructs, two kinds of measurement models are applied. These models differ in terms of their underlying assumptions about the causal relationship between the latent construct and its indicators (observed variable) (Bollen, 2014). The measurement models are the reflective and formative models. Technically, the main difference between the reflective and formative measures is that reflective measures are expected to have high correlations, which is usually tested using exploratory or confirmatory factor analysis. Also, the unidimensionality of the scale by inter-correlation can be assessed using Cronbach's alpha. Formative measures are not expected to correlate. The development and validation of multi-item scales are based on reflective measures while formative measures involve the creation of an index rather a scale (Bollen and Lennox, 1991).

According to Coltman, et al. (2008), there are three broad theoretical and empirical considerations which are important in deciding whether the measurement model will be reflective or formative. These considerations are explained in the table below

Considerations	**Reflective Models**	**Formative Models**	**Literature**
Theoretical Considerations			
1. Nature of Construct	Latent construct is existing • Latent construct exists independent of the measures used.	Latent construct is formed • Latent constructs is determined as a combination of its indicators	Borsboom, et al. (2003; 2004)
2. Direction of causality between items and latent construct	Causality from construct to items • Variation in the construct causes variation in the item measures • Variation in item measures does not cause	Causality from items to construct • Variation in the construct does not cause variation in the item measures • Variation in item measures causes	Jarvis, et al. (2003); Rossiter (2002); Edwards and Bagozzi (2000) and Bollen and Lennox (1991);

	variation in the construct	variation in the construct	
3. Characteristics of items used to measure the construct	Items are manifested by the construct • Items share a common theme • Items are interchangeable • Adding or dropping an item does not change the conceptual domain of the construct	Items define the construct • Items need not share a common theme • Items are not interchangeable • Adding or dropping an item may change the conceptual domain of the construct	Rossiter (2002) and Jarvis, et al. (2003)
Empirical Considerations			
4. Item Intercorrelation	Items should have high positive intercorrelations • Empirical test: internal consistency and reliability assessed via Cronbach alpha, average variance extracted, and factor loadings (e.g., from common or confirmatory factor analysis)	Items can have any pattern of intercorrelation but should possess the same directional relationship • Empirical test: indicator reliability cannot be assessed empirically; various preliminary analyses are useful to check directionality between items and construct	Diamantopoulos and Siguaw (2006); Nunnally and Bernstein (1994); Churchill (1979) and Cronbach (1951)

5. Item relationships with construct antecedents and consequences	Items have similar sign and significance of relationships with the antecedents/consequences as the construct • Empirical test: content validity is established based on theoretical considerations, and assessed empirically via convergent and discriminant validity	Items may not have similar significance of relationships with the antecedents/consequences as the construct • Empirical test: nomological validity can be assessed empirically using a MIMIC model, and/or structural linkage with another criterion variable	Diamantopoulos and Siguaw (2006); Diamantopoulos and Winklhofer (2001) and Bollen and Lennox (1991)
6. Measurement error and collinearity	Error term in items can be identified • Empirical test: common factor analysis can be used to identify and extract out measurement error	Error term cannot be identified if the formative measurement model is estimated in isolation • Empirical test: vanishing tetrad test can be used to determine if the formative items behave as predicted • Collinearity should be ruled out by standard diagnostics such as the condition index	Diamantopoulos (2006) and Bollen and Ting (2000)

Table 10: A Framework for Assessing Reflective and Formative Models: Theoretical and Empirical Considerations (Coltman, et. al, 2008)

As understood from literature, most personal scales are constructed as reflective (Simonetto, 2011). According to Coltman, et al. (2008), management researchers often identify structural relationships among latent, unobserved constructs by statistically relating covariation between the latent constructs and the observed variables (indicators of the latent constructs). This enables the researcher to argue that if a variation in an indicator X, is associated with a variation in a latent variable Y, then exogenous interventions that a change in Y can be detected in the indicator X. This means that a change in X reflects the change in the latent construct Y. Causality flows from the latent construct to the indicator.

Based on these explanations, the measurement model adopted in the research is reflective.

6.4 MISSING VALUES

Most often, data files usually contain series of missing data. Not all missing values are created equal. For instance, missing values may have recorded as a result of

- Skip logic pattern used in the survey
- Refusal of respondents to continue to participate
- Respondents did not know what to answer
- Invalid data
- Unclear questions etc.

Due to the nature of this online survey design, missing values were recorded as a result of the skip logic function used. The dataset revealed series of missing values (MVs) but literally, they were not missing values per se. This is because since the questions were distributed based on different categories of participants, any question that a particular category was not qualified to answer recorded as a missing value. Although, no genuinely missing value was recorded as all questions were made compulsory to all qualifying respondents.

All I don’t know options were initially treated as missing values (without assigning any value to them) then subsequently imputed using multiple imputation method. Multiple imputation (MI) method has been widely used and mentioned by many researchers (Yuan, 2010; King, et al., 2001; and Allison, 1999) as the best method of handling missing data when the proportion of missing value is high (> 5%). It can be done using any kind of data or model with conventional software (Soley-Bori, 2013). Being that the consequence of "I don't know" responses is similar to an invalid refusal which will generate an incomplete data and all its associated problems, multiple imputation is a way of validating the "don't knows" responses and including them in the analysis (Kroh, 2006). The MI process was to done so that responses with I don’t know options could be considered valid and not to pose any problem during the analysis. It was also done in order not to lose cases in the final analysis and to make the result more inclusive (Kirsten, et al., 1997; Conley, 1997).

Multiple imputation tends to replace the MVs multiple times then take an average of the replacements. It is used when there are data missing due to non-response or drop out of subjects, if the sample size is to be maintained for all variables (Schlomer, Bauman and Card, 2010). It is also used when data is missing in a systematic way. MI looks at the patterns in the available data and makes a probability judgment of what the MVs will be and replaces them with imputed values in order to create a full dataset. Compared to single imputation (done when the proportion MVs is less than 5%), MI is usually done when the proportion of MVs is high. MI techniques have been widely used to handle missing data (see Schlomer,Bauman and Card, 2010; Yuan, 2010; Graham, 2009; Wayman, 2003 and Schafer, 1999).

Before carrying out the MI technique, the pattern of missing data was first analysed to explore the patterns of the MVs and provide descriptive measures of the patterns. This is usually done before the MI techniques.

The MI technique has only been performed on items containing the “I don’t know” options (questions 3, 6, 7, 8, 9.1- 9.11, 12, 13.1 - 13.8, 14.1 – 14.4, 15.1 – 15.10, 16.1 – 16.4, 17.1 – 17.5, 18.1 – 18.6, 20.1 – 20.16).

The table below represents the percentage of imputations done per variables used in the data analysis. Out of all variables used for the analysis, only question 5 (knowledge level of cloud computing) was not imputed because it did not have any "I don't know" response option.

Variable	Number of Cases	Percentage of Imputation	Valid Number of Respondents for each question

Company Size (Q.3)	1	0.38%	263
Perceived Benefits of Cloud Computing (Q.6)	9	4.15%	217
Adoption Status of Cloud Computing (Q.7)	9	4.15%	217
Perceived Usefulness of Cloud Computing (Q.8)	14	6.45%	217
Challenges of Cloud Computing (Q.9) 9.1 9.2 - 9.4 9.5 - 9.6 9.7 9.8 9.9 9.10 9.11	 19 17 20 33 23 30 23 24	 9.1% 8.2% 9.6% 15.9% 11.1% 14.4% 11.1% 11.5%	208
Reliability of Cloud Service Provider (Q.15.6)	6	3.7%	162

Trust Rating of Cloud Service Provider (Q.20)			102
20.1	4	3.9%	
20.2	3	2.9%	
20.3 - 20.4	9	8.8%	
20.5 - 20.7	6	5.9%	
20.8 - 20.9	5	4.9%	
20.10	7	6.9%	
20.11	11	10.8%	
20.12	17	16.7%	
20.13	6	5.9%	
20.14	9	8.8%	
20.15	4	3.9%	
20.16	10	9.8%	

Table 11: Percentage of Variables Imputations

6.5 CHAPTER SUMMARY

In this chapter, a description of research design was given. This research utilised the quantitative method, the positivism philosophy and the deductive approach. Justifications for using these approaches were given. The study consisted of both primary and secondary data, with the primary data collected through an online survey and the secondary data collected from recent publications (journals, articles, theses, books etc.), and internet sources in this area of research. The stages of the research design were given. Data definitions and measures (both from the original sources and all subsequent adaptations), the design of the questionnaire, pilot study and final survey were also presented. The method of handling any related bias introduced in the research was discussed. In terms of missing values, none was recorded genuinely because all questions were made compulsory. Due to the design of the survey, missing values were recorded as a result of skip logic used while designing the questions. Since the questions were distributed based on different categories of participants, any question that a particular category was not qualified to answer recorded as a missing value. The method of treating these recorded missing values was also discussed. The next chapter will discuss the result analysis.

CHAPTER 7

RESULTS

This chapter presents the data analysis. This data analysis was done using Statistical Package for Social Sciences (SPSS v.20). This chapter is divided into two parts. The first part was done to test hypothesis 1 and 2 while the second part was done to test hypothesis 3. In the first part of the analysis, the dependent variable used was the adoption status of cloud computing (Q.7), the independent variables were knowledge level of cloud computing (Q.5) and the challenges of cloud computing (Q.91 – 9.11). The control variables in first part were company size (Q.3), cloud computing benefits (Q.6) and the perceived usefulness of cloud computing (Q.8).

The second part of the analysis used perceived usefulness of cloud computing (Q.8) as its dependent variable, trust in CSPs (Q.20.1 to Q20.13) as independent variable and the reliability of the service provider (Q.15.6) as a control variable. The description of each variable is given in each part of the analysis below.

7.1 PART ONE

7.1.1 DESCRIPTIVE STATISTICS

In this section, a detailed description of each variable used in part one of the analysis is given. Since all variables used in the analysis were categorical (ordinal) in nature, their frequencies and valid percentages have been reported. These are illustrated in the table below:

Descriptive Statistics of Variables Used in Part One of Data Analysis		
Variable	Frequency	Valid Percent
Dependent Variable **Adoption Status of Cloud Computing (Q.7)**		
(1) My company neither uses nor plans to use cloud computing services.	51	23.5
(2) My company is thinking of using cloud service in the future.	33	15.2
(3) My company is planning to use cloud service.	27	12.4

(4) My company is using cloud service.	106	48.8
TOTAL	217	100
Independent Variables		
Knowledge Level of Cloud Computing (Q.5)	Frequency	Valid Percent
(1) I have no knowledge of cloud computing	26	10.7
(2) I have little knowledge of cloud computing	39	16.0
(3) I have some knowledge of cloud computing	67	27.6
(4) I have good fundamental knowledge of cloud computing	71	29.2
(5) I am an expert in cloud computing	40	16.5
TOTAL	243	100
Challenges of Cloud Computing (Q.9)		
(Q.9.1) Regulatory Compliance		
(1) Strongly Disagree	10	4.8
(2) Disagree	24	11.5
(3) Neither Agree nor Disagree	23	11.1
(4) Agree	50	24.0
(5) Strongly Agree	101	48.6
(Q.9.2) Cost and Difficulty of Migration		
(1) Strongly Disagree	13	6.3
(2) Disagree	24	11.5

(3) Neither Agree nor Disagree	26	12.5
(4) Agree	46	22.1
(5) Strongly Agree	99	47.6
(Q.9.3) Lack of Privacy		
(1) Strongly Disagree	14	6.7
(2) Disagree	28	13.5
(3) Neither Agree nor Disagree	19	9.1
(4) Agree	56	26.9
(5) Strongly Agree	91	43.8
(Q.9.4) Lack of Availability of Service and/data		
(1) Strongly Disagree	22	10.6
(2) Disagree	27	13.0
(3) Neither Agree nor Disagree	28	13.5
(4) Agree	44	21.2
(5) Strongly Agree	87	41.8
(Q.9.5) Lack of Confidentiality of Data		
(1) Strongly Disagree	18	8.7
(2) Disagree	24	11.5
(3) Neither Agree nor Disagree	25	12.0
(4) Agree	45	21.6
(5) Strongly Agree	96	46.2

(Q.9.6) Lack of Data Integrity		
(1) Strongly Disagree	18	8.7
(2) Disagree	25	12.0
(3) Neither Agree nor Disagree	20	9.6
(4) Agree	42	20.2
(5) Strongly Agree	103	49.5
(Q.9.7) Lack of Liability of Providers in Case of Security Incidence		
(1) Strongly Disagree	24	11.5
(2) Disagree	23	11.1
(3) Neither Agree nor Disagree	25	12.0
(4) Agree	48	23.1
(5) Strongly Agree	88	42.3
(Q.9.8) Loss of Control of Service		
(1) Strongly Disagree	18	8.7
(2) Disagree	22	10.6
(3) Neither Agree nor Disagree	27	13.0
(4) Agree	49	23.6
(5) Strongly Agree	92	44.2
(Q.9.9) Malicious Insider within the CSP's Organisation		

(1) Strongly Disagree	11	5.3
(2) Disagree	27	13.0
(3) Neither Agree nor Disagree	25	12.0
(4) Agree	43	20.7
(5) Strongly Agree	102	49.0
(Q.9.10) Service Level Agreement (SLA) Issues		
(1) Strongly Disagree	9	4.3
(2) Disagree	35	16.8
(3) Neither Agree nor Disagree	22	10.6
(4) Agree	46	22.1
(5) Strongly Agree	96	46.2
(Q.9.11) CSP's Contract Lock-in		
(1) Strongly Disagree	12	5.8
(2) Disagree	18	8.7
(3) Neither Agree nor Disagree	29	13.9
(4) Agree	37	17.8
(5) Strongly Agree	112	53.8
TOTAL NUMBER OF RESPONSES FOR Q.9.1 TO 9.11	208	100
Control Variables		
Company Size (Q.3)	Frequency	Valid Percent
(1) 1 - 9 Employees	53	20.2

(2) 10 - 49 Employees	107	40.7
(3) 50 - 249 Employees	84	31.9
(4) 250+ Employees	19	7.2
TOTAL	263	100
Perceived Benefits of Cloud Computing (Q.6)		
(1) No, not beneficial	17	7.8
(2) Yes, less beneficial	34	15.7
(3) Yes, beneficial	87	40.0
(4) Yes, very beneficial	79	36.4
TOTAL	217	100
Perceived Usefulness of Cloud Computing (Q.8)		
(1) Not Useful	24	11.1
(2) Less Useful	24	11.1
(3) Useful	79	36.4
(4) Very Useful	90	41.5
TOTAL	217	100

Table 12: Descriptive Statistics of Variables Used in Part One of Data Analysis.

7.1.1.1 RESPONDENTS' COMPANY SIZE (3)

As explained above, this question was designed to filter out those respondents whose companies were not under the category of SMEs. From the table above, it can be seen that majority of companies have employees between 10 – 49 (40.7%). Those cases that indicated 250+ employees were excluded from further investigation.

7.1.1.2 RESPONDENTS' CLOUD COMPUTING KNOWLEDGE LEVEL (QUESTION 5).

This question was created to help filter out those respondents who had no knowledge of cloud computing since the rest of the questions were designed for those with knowledge of cloud computing.

As shown in table 12 above, 29.2% of the survey respondents had good fundamental knowledge of cloud computing, 27.6% had some knowledge of cloud computing while 16.5% were experts of cloud computing. This indicates that cloud computing is well known to most of the survey respondents. These statistics are promising for this type of investigation. Also, those with little knowledge of cloud computing (16%) were included for further investigation while those with no knowledge of cloud computing (10.7%) were excluded automatically from the survey. This was done because their responses were considered invalid for the rest of the questions.

7.1.1.3 RESPONDENTS' VIEW OF BENEFITS OF CLOUD COMPUTING (QUESTION 6).

This question was only answered by those who indicated the following on question 5.

- I have little knowledge of cloud computing
- I have some knowledge of cloud computing
- I have good fundamental knowledge of cloud computing
- I am an expert in cloud computing

Those who were not familiar with the concept of cloud computing were excluded from answering this question. As shown in the table above, 40% of survey respondents indicated that cloud computing is beneficial, 36.4% indicated that cloud computing is very beneficial, 15.7% said it is less beneficial while the remaining 7.8% said it is not beneficial. Based on the figures displayed here, it is evident that the largest proportion of the respondents think that cloud computing is either very beneficial or just beneficial. Either way, it means that cloud computing offers lots benefits to their organisations.

7.1.1.4 ADOPTION STATUS OF CLOUD COMPUTING IN RESPONDENTS' COMPANY (QUESTION 7).

This question was designed to help narrow down the survey questions to specific categories of SMEs in terms of their cloud computing adoption status. Table 12 above shows the distribution of responses in the dependent variable. As can be seen, the biggest class of respondents were those already using cloud computing (48.8%). The percentage of those neither using nor planning to use cloud computing services (23.5%) are also prominent. Interestingly, those thinking of using cloud services (15.2%) are not quite different from those already planning to use cloud services (12.4%).

7.1.1.5 PERCEIVED USEFULNESS OF CLOUD COMPUTING (QUESTION 8).

This question was answered by all respondents who answered question 7. As shown in table 12 above, 41.5% of the survey respondents perceived cloud computing as very useful, 36.4% indicated that cloud computing is useful, 11.1% said it is less useful while the remaining 11.1% said it is not useful. Since the largest proportion of the participants indicated that cloud computing is either very useful or useful, it means that cloud computing is perceived as a good option for their organisations. Further analysis would reveal whether perceived usefulness of cloud computing has any influence on the adoption status of cloud computing.

7.1.1.6 CHALLENGES OF CLOUD COMPUTING (QUESTION 9.1 TO 9.11).

These questions were designed to indicate the level of agreement or disagreement (in a 5-point scale) regarding the challenges of cloud computing adoption.

As evident in table 12 above, the most frequent response on all stated challenges of cloud computing was "strongly agree" and "agree". Since this question was answered by all categories of cloud computing adopters (Q.7), except those who initially indicated I don't know (although imputed), it means that the stated challenges of cloud computing are still concerns before and after adoption. Further analysis would reveal the influence of these issues of the adoption of cloud computing (see Section 7.1.6).

Items on this scale were checked for reliability using Cronbach's Alpha. Result of this analysis is presented below.

7.1.2 RELIABILITY TEST OF ALL VARIABLES RELATING TO CHALLENGES OF CLOUD COMPUTING (CC) (QUESTIONS 9.1 TO 9.11).

According to Bryman and Bell (2015), reliability refers to a measure of concept in order to consider its stability, internal reliability and inter-rater reliability. Internal reliability explains whether or not the indicators that make up a scale are consistent. Inter-rater reliability involves the use of activities consisting of recording of observations into categories where more than one rater is involved, to make a judgement. In statistics, Cronbach's alpha is the most common measure of reliability. It is used when there are multiple Likert-scale type questions in a questionnaire/survey. It is employed to test whether the questions that make up the scales are reliable.

A computed Cronbach's alpha score coefficient lies between 1 and 0. 1 denoting perfect internal reliability and 0 denoting no internal reliability (Bryman and Bell, 2015). This means that the closer the alpha is to 1, the greater the internal consistency of the items on the scale. As a rule of thumb, Cronbach's alpha coefficient of anything above 0.8 is typically employed to denote an acceptable level of internal reliability. Although, many researchers accept a slightly lower figure. For example, Schutte, et al. (2000) suggested a minimum criterion of 0.7 as a rule of thumb.

Reliability Statistics for All Items in Question 9

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.937	**.937**	**11**

Table 13: Reliability Statistics of All Variables Relating to the Challenges of Cloud Computing (Question 9.1 to 9.11)

Item-Total Statistics		
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Regulatory Compliance (Q.9.1)	.712	.932
Cost and Difficulty of Migration (Q.9.2)	.739	.931
Lack of Privacy (Q.9.3)	.805	.928
Lack of Privacy (Q.9.3)	.757	.930
Lack of Data Confidentiality (Q.9.5)	.782	.929

Lack of Data Integrity (Q.9.6)	.780	.929
Lack of Liability of Provider in Case of Security Incidence (Q.9.7)	.672	.932
Loss of Control of Service (Q.9.8)	.714	.932
Malicious insider with the CSP's Organisation (Q.9.9)	.643	.934
Service Level Agreement Issues (Q.9.10)	.759	.930
CSP's Contract Lock-in (Q.9.11)	.683	.933

Table 14: Item-Total Statistics of All Variables Relating to Challenges of Cloud Computing (Question 9.1 to 9.11)

As shown in table 13 above, the Alpha value of α = .937 is very high (much higher than the accepted cut-offs of 0.7 - 0.8). This indicates strong/excellent internal consistency among all 11 items. It essentially means that the questions measure conceptually similar things and respondents who selected high scores for one CC adoption challenge item must have selected high scores for the others. In a similar manner, respondents who selected low scores for one CC adoption challenge item must have also selected low scores for the other items. As a result, knowing the score selected for one CC adoption challenge item would enable one to predict what the scores for the other 10 items would be, with some level of uncertainty of course. If the Alpha value had been low, then the ability to predict scores would not be possible at all. The scale would not have internal consistency.

In table 14, the column "Corrected Item-Total Correlation" shows the correlation (r) between a particular CC challenge item and the sum of the other 10 challenges. For example, the correlation between item 1 (Regulatory Compliance 9.1) and the sum of the other 10 items is .712. This figure means that there is a strong positive relationship between item 1 and the sum of the scores of the others. This correlation helps to assess the extent to which one item's score is internally consistent with the composite scores of the remaining items. But if the correlation is weak (anything less than .3 as suggested by Vaus, 2004), then the item should be deleted from the scale because it is not internally consistent (measuring the same thing) with the rest of the items.

From the above output, the best item appears to be item 3 (Lack of Privacy 9.3) with an item-total correlation coefficient of r = .805 while item 9 (Malicious Insider with CSP's Organisation 9.9) has the lowest item correlation coefficient (r = .643). Since all the items have very strong and strong positive relationships between them (Corrected Item-Total Correlations), no item was removed from the scale.

The column “Cronbach’s Alpha if item deleted” shows what the Cronbach’s Alpha would be if a particular item were deleted from the scale. In the above output, using item 1 as an example, the Cronbach’s Alpha if item 1 is deleted would drop from the overall Cronbach’s Alpha of .937 to .932. Since none of the values under the column “Cronbach’s Alpha if item deleted” appeared to be more than the overall Cronbach’s Alpha value of .937, there was no statistical reason for removing any of the items. Also, all the items appeared to correlate well with the composite scores of the rest of the items. This implies that they were reliable were all be retained in the scale.

The usual way to actually construct a composite score from this scale is via factor analysis. This was presented as follows (section 7.1.4).

7.1.3 UNIVARIATE ANALYSIS, FURTHER RECODING AND DIMENSIONALITY REDUCTION.

In the following, the independent variables in the first two sets of hypotheses were tested separately against the corresponding dependent variable (the adoption of cloud computing). This was done to exclude any independent variables that proved to be non-significant at level 0.05, reduce the number of combinations of values (“cells”) and also collapse the categories having fewer observations. In the following, a series of chi-square tests were conducted to test the association between two categorical variables.

The test statistic is calculated on the basis of the observed vs. expected counts, the latter if the null hypothesis of uniformity holds. This statistic follows the chi-square distribution, hence the name. If its value is high enough, i.e. the probability of observing this value or higher if the null hypothesis holds is smaller than a given significance level alpha (typically 0.05), then the null hypothesis of uniformity is rejected at this level of significance and the alternative hypothesis of association is accepted.

Dependent variable: Cloud Computing Adoption Status

- A test of association was conducted between company size (Question 3) and the dependent variable (question 7). The association was found significant (X2(6) =25.9, p-value practically zero), as the percentages of adoption were clearly different in the size categories (higher adoption in larger companies). This clearly differentiates users from non-users. This variable was reserved for further analysis.

- For the purposes of the analyses in this section, and in order to reduce the combinations of values of categorical variables, perceived knowledge of cloud computing (Question 5) was recoded into 3 levels ("No/Little knowledge", Some Knowledge and "Good knowledge/expert in cloud computing"). The recoded knowledge variable showed significant association with the dependent variable (X2(6) =94.8, p<.01) thus was reserved for further analysis. There are much pronounced differences in the proportions of respondents' knowledge level of cloud computing between those already using cloud computing and those neither using, thinking of using and planning to use of cloud computing.
- For the same purposes of reducing combinations of values of categorical variables, perceived benefits variables (Question 6) was recoded into 3 levels ("No, not beneficial", "Yes, less beneficial" and "Yes, beneficial/yes, very beneficial"). The recoded perceived benefits variable showed significant association with the dependent variable (X2(6) =67.1, p<.01). But another problem found was that 4 cells (33.3%) had expected count less than 5, which violates the assumption of the chi-square test. This variable was further recoded into two categories (No, Not beneficial/Yes, less beneficial; Yes, beneficial/yes, very beneficial) with a repeated chi-square test. The repeated result showed a significant result (X2(3) =60.5, p<.01) with 0 cells having an expected count less than 5. As a result, this variable was reserved for further investigation.
- Another variable which was tested for significant association with the dependent variable was Perceived Usefulness of Cloud Computing (Question 8). Reducing responses in this variable into 3 categories (Not Useful, Less Useful, Very Useful) produced a significant result with p value practically zero (X2(6) = 97.8, p<.001).

7.1.4 FACTOR ANALYSIS FOR QUESTIONS MEASURING CHALLENGES OF CLOUD COMPUTING ADOPTION (Q.9.1 – 9.11).

Factor analysis was conducted for the set of questions relating to the challenges of cloud computing adoption (Questions 9.1-9.11). Factor analysis is a type of multivariate statistical technique used to examine correlations between variables. Factor analysis can be used to reduce a large number of related variables to a more manageable number prior to using them in other analysis (e.g Multiple regression) (Pallant, 2013). Factor analysis is one way to evaluate construct validity. In order to evaluate construct validity, there is a need for the examination of correlations between variables that are related to the construct.

Construct validity defines the underlying structure of constructs. Construct validity can be assessed by checking the discriminant and convergent validity (Bryman, 2012). Discriminant validity explains whether constructs that are supposed to be unrelated are actually unrelated while convergent validity explains the degree at which indicators of a construct that are supposed to be correlated are actually correlated (Pallant, 2013). In other words, discriminant validity explains the extent to which constructs are different and uncorrelated; while convergent validity helps to determine whether items intending to measure a particular construct actually measure that construct (Hair, et al., 2010). One way to check convergent validity is by assessing factor loadings under the pattern matrix column of the factor analysis result in SPSS. Factor loadings represent how much a factor (component) explains a variable in factor analysis. According to Hair, et al. (1995), the minimum acceptable factor loading should be ± 0.3, ± 0.4 is important; but in general above ± 0.5 is practically significant.

In terms of assessing discriminant validity, the rule is that variables should only load significantly to one factor and no other. This means that there should be no cross-loadings (variables loading on multiple factors). If cross-loadings exist, it means that the item is not actually measuring one factor but different factors.

As seen in literature, factor analysis is classified into two main approaches. The Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) (Bryman, 2012). The EFA as the name implies is used to summaries the underlying correlation structure of a dataset (information about the interrelationships among a set of variables) while CFA is used to test a specific hypothesis or theories concerning the structure underlying a set of variable (Pallant, 2013). EFA is one way to test for both discriminant and convergent validity of an instrument. In this research, using a total of the 11 variables in question 9, the EFA technique was performed to check the correlations between the measured variables.

The extraction method used in this analysis was Principal Components based on Eigenvalues greater than 1 rule. Eigenvalue is a measure of how much of the variance of the observed value a factor explains. Apart from being the default in most statistical packages, Principal Components method is a technique used to reduce variables. It maximises the amount of variance accounted for in the observed variables and reduces them to a smaller group of factors known as components (Pallant, 2013). Eigenvalue explains the amount of total variance explained by a factor and Kaiser's criterion for Eigenvalue rule is that only factors with Eigenvalue greater than 1 or more are retained for further analysis (Kaiser and Rice, 1974). Another criterion commonly used is based on the "scree-plot" which shows the eigenvalues as a function of the number of factors (components). With careful observation, it shows where the slope of the curve levels out just after 1 factor with an Eigenvalue greater than 1.

Conducting the factor analysis using the default settings produced a one-factor solution (named CC_CHALLENGES_9 for better understanding), which explained a total variance of 61.49%. The 61.49% of variance explained was considered a very good value because any value greater than 50 is good but 60 or above is better (Jolliffe, 2002). The scree-plot also suggested the extraction of one factor only. Since only one component was extracted, the solution was not rotated.

7.3.1 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.948
Bartlett's Test of Sphericity	Approx. Chi-Square	1503.242
	df	55
	sig.	.000

Table 15: KMO and Barlett's Test of Sphericity

The table above shows the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. As the names imply, the KMO test is used to assess the suitability of data for factor analysis. It considers two main things in order to determine whether data can be grouped into underlying factors. These are sample size and the strength of relationship among variables.

According to Hair, et al. (2010), the sample size to be used for factor analysis should not be less than 50 but preferably greater than 100. The sample size should be greater than the number of variables and at least 5 cases are needed for each variable but preferable 10 and above as acceptable ratio (10:1). The number of variables needed is at least 3 and more than 100 is tasking. Based on this understanding, the sample size for this research was considered more than adequate for factor analysis. The KMO index ranges from 0 to 1 with 0.6 suggested as the acceptable minimum but 0.8 or greater is better.

In this case, the KMO index of 0.95, is characterised as "marvellous" according to the rule of thumb for interpreting the KMO test (see the table below). In other words, this value indicates that the sample size and strength of correlation (usually >.3) among variables were adequate for factor analysis.

KMO Coefficient	Interpretation
0.90 and above	Marvellous
0.80 - 0.90	Meritorious
0.70 - 0.80	Middling
0.60 – 0.70	Mediocre
0.50 – 0.60	Miserable
<0.50	Unacceptable

Table 16: Rule of Thumb for KMO test (Kaiser and Rice, 1974; Hair et.al, 1995).

Bartlett's test evaluates whether or not the correlation matrix is an identity matrix (1s on the diagonal and 0s off diagonal). Running a simple correlation test on the variables indicated that the correlation matrix was not an identity matrix. Therefore, the Bartlett's test figure (.000) as shown in table 15 means that the correlation among variables was significant (approx. chi-square statistic 1503 with 55 degrees of freedom, p-value practically 0) and factor analysis was adequate.

Component Matrix

Variables	CC_CHALLENGES_9
	1
Regulatory Compliance (Q.9.1)	.767
Cost and Difficulty of Migration (Q.9.2)	.791
Lack of Privacy (Q.9.3)	.849
Lack of Service/Data Availability (Q.9.4)	.807
Lack of Data Confidentiality (Q.9.5)	.830

Lack of Data Integrity (Q.9.6)	.826
Lack of Liability of Provider in Case of Security Incidence (Q.9.7)	.728
Loss of Control of Service (Q.9.8)	.766
Malicious insider with the CSP's Organisation (Q.9.9)	.701
Service Level Agreement Issues (Q.9.10)	.806
CSP's Contract Lock-in (Q.9.11)	.739

Extraction Method: Principal Component Analysis.

Table 17: Component Loadings of Variables Relating to Challenges of Cloud Computing.

Table 17 represents the component loadings derived from the factor analysis. These are simply the correlations between variables and the extracted component. Since these are correlations with possible values ranging from -1 to +1, and all the variables appeared to have a very strong positive correlation with the extracted component, the component was retained for use in further analysis.

7.1.5 CONFIRMATORY FACTOR ANALYSIS

Using 208 observations for the CC_Challenges items (9.1 to 9.11), an EFA shows that 11 items clearly form a unidimensional scale because there is one dominant factor emerging out of the analysis. Similarly, the items which make up the trustworthiness scale (20.1 to 20.13) also produced a similar result because only one dominant factor was extracted from the analysis.

In order to perform a test of discriminant validity between CC_challenges and trust, I tested whether the two multi-item scales in the analysis - cloud computing challenges and perceived trustworthiness - are empirically distinct. I estimated a confirmatory factor analysis (CFA) model comprising two factors: one for cloud computing challenges and one for perceived trustworthiness. The two-factor solution shows satisfactory fit with the data (Hu and Bentler, 1999): comparative fit index (CFI) = 0.94; standardized root mean squared residual (SRMR) = 0.05; root mean squared error of approximation (RMSEA) = 0.08. The two-factor solution provides a significantly better fit than a one-factor solution where all items belonging to these scales load on a single factor (chi-squared test with 3 degrees of freedom: 532.34, $p<0.000$). Therefore, I can conclude that these two scales are empirically distinct and discriminant validity is thus supported. Therefore, a confirmatory factor analysis has now been used to establish discriminant validity.

7.1.6 ORDINAL REGRESSION MODEL

7.1.6.1 TESTING HYPOTHESES 1 AND 2

In this section ordinal regression analysis was conducted to test Hypotheses 1and 2. The dependent variable used was the adoption status of cloud computing and the independent and control variables have been stated below:

- The knowledge level of cloud computing.
- The factor extracted from Questions 9.1-9.11 on the Challenges of Cloud Computing (see section 7.1.4)
- Company Size
- The perceived benefits of cloud computing
- The perceived usefulness of cloud computing.

Regression analysis is a statistical technique aimed at examining associations between variables while controlling for effects of other variables. These associations are usually between independent (predictor) variables and a dependent (response) variable (Sykes, 1993). Generally, there are different forms of regression analysis. Secondly, the nature of the data determines the type of regression analysis to use. For example, the ordinal regression is used with an ordinal dependent variable, logistic regression is used when dealing with a categorical dichotomous dependent variable, multinomial logistic regression is used when dealing with a polytomous or multinomial (non-ordinal/nominal) dependent variable, etc.

In order to test the current research hypotheses, ordinal regression was used. Ordinal regression is exactly a type of regression used when the variable of interest is in ranking order (ordinal in nature) but no known distance exists between the ranked orders. It is used to explore the relationship between an ordinal dependent variable and one or more independent variables (of any type). The depending variable (cloud computing adoption status) is ordinal. It ranges from neither using cloud computing, thinking of using cloud computing, planning to use cloud computing and those already using cloud computing (see section 7.1.1 table 12). There is therefore a natural order in the categories of the variable, although of course this is a ranking order only and not one which allows any arithmetic distance.

Prior to this ordinal regression analysis, just like in other types of regression, there are some assumptions that must be tested to ensure the applicability of the analysis. These assumptions are as follows (Hair, 2010):

- The dependent variable should be measured at an ordinal level
- Independent variables can either be continuous, ordinal or categorical. Ordinal independent variables must be treated as either categorical or continuous.
- There should be no multicollinearity between the independent variables. This means that they should not be highly correlated.
- There are proportional odds. This was assessed using the test of parallel lines. More details on what this assumption means and how this assumption was tested can be found below.

In this research, the dependent variable being the adoption status of cloud computing is an ordinal variable. Those who have already adopted cloud computing rank higher than those planning, thinking and those not using cloud computing. Those already planning to use cloud computing also rank higher than those thinking of using of cloud computing. In a similar manner, those thinking of adopting cloud computing rank higher than those who are neither using nor planning to use. And the ordinal nature of these response categories has no measurable distances between them.

Another important assumption, which was tested, is multicollinearity between independent variables. Multicollinearity refers to the existence of high correlation between the independent variables. Multicollinearity can influence the predictability of the model, the estimation of coefficient values and their significance levels (Hair, et.al, 2010). In simple words, it can change the values and signs of the coefficients and cause the results not to be significant. Testing for multicollinearity between independent variables should be a very important consideration when performing a regression analysis with several dependent variables. Ideally, there should be high correlation between the dependent variable and the independent variables (Tehrani, 2013) but none among the independent variables. To check for multicollinearity between independent variables, two most popular measures are used. These are tolerance and variance inflation factor (VIF). Tolerance indicates the percentage of variance in the dependent variable that cannot be accounted for by other independent variables. VIF on the other hand is the inverse of tolerance value (VIF=1/Tolerance). For instance, a VIF level of 10 corresponds to 0.1 of tolerance.

According to Martz (2013), a VIF value of 1 signifies no evidence of multicollinearity among the independent variables but a VIF value greater than 1, means that the independent variables may be moderately correlated. Different authors recommend different acceptable levels of VIF. The most common ones are a maximum value of 10 (Hair, et.al, 1995; Kennedy, 1992; and Marquardt, 1970). However, a maximum VIF value of 4 (Pan and Jackson, 2008) and 5 (Rogerson, 2014) have also been found in literature.

For this research all independent variables have been checked for multicollinearity amongst themselves and they meet maximum threshold of <5 for VIF and >0.2 for tolerance (Rogerson, 2014). The table below is an example of multicollinearity test between CC_CHALLENGES_9 and variable 3 (company size), 5 (knowledge level of cloud computing), 6 (perceived benefits of cloud computing) and 8 (perceived usefulness of cloud computing), using CC_CHALLENGES_9 as the dependent variable.

Coefficients

Model	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
Perceived Usefulness of Cloud Computing (Q.8)	.588	1.701
Perceived Benefits of Cloud Computing (Q.6)	.655	1.527
Knowledge Level of Cloud Computing (Q.5)	.644	1.554
Company Size (Q.3)	.937	1.068

a. Dependent Variable: REGR factor score_ CC_CHALLENGES_9

Table 18: Collinearity Test Example

From the table above, variable Q.3 barely shows any evidence of multicollinearity with CC_CHALLENGES_9 ((VIF ≈ 1). But variables Q.5, Q.6 and Q.8 have VIF values higher than 1.5. This means that they may be moderately correlated with the "CC_CHALLENGES_9" variable, but not enough to be too concerned about. A VIF value of between 5 and 10 indicates high level of correlation which poses a problem (Rogerson, 2014). All the variables have been checked for multicollinearity against themselves and the highest VIF value was less than 2.

The first regression model was estimated using only the control variables (Company size (Q.3), Perceived Benefits of Cloud Computing (Q.6) and Perceived Usefulness of Cloud Computing (8)). This model showed Pearson chi-square goodness of fit value of .021 (<. 05). It means that the model did not have a good fit. In order to check for improvement or robustness of the model, a final model was estimated by adding the independent variables "CC_CHALLENGES_9 and Knowledge Level of Cloud Computing''. The model improved its goodness of fit with a Pearson chi-square value of p=.188 (>.05). It also improved the proportional odds assumption based on the significance value of the chi-square statistic (.19 >.05) and the Pseudo R-Squared value (Nagelkerke Pseudo R- square from .468 to .586).

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	507.655			
Final	347.397	160.259	8	.000
Pseudo R-Square				
Cox and Snell	.537			
Nagelkerke	.586			
McFadden	.311			
Test of Parallel Lines				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	347.397			
General	333.925	13.472	8	.638

Link function: Logit.

Table 19: Ordinal Regression Statistics for Part One Analysis

The Model Fitting Information gives the -2 log-likelihood values for the baseline and the final model, and performs a chi-square test to check the difference between the -2Log Likelihood for the two models. It tells how well the model fits the data. It is used to determine whether the model improves the researcher's ability to predict the outcome. Firstly, a model without any independent variable (intercept only) is compared with the final model (the model with all dependent variables). The final model is compared against the baseline or intercept only model to see if it significantly improves the fit of the data. With a p <.001, it can be explained that the final model gives a significant improvement over the baseline model. This can also be seen in the differences in the -2 (Log Likelihood) values associated with the models.

As mentioned by Pallant (2013), the R-square is the coefficient of determination. Literarily, it is the correlation coefficient squared. Pallant further explained that the R-squared indicates how much variance in the dependent variable can be explained by the independent variable. It is represented as a proportion between 0 and 1, with 0 indicating no variation in the dependent variable and 1 indicating a perfect prediction of variation in the dependent variable (Norusis, 2007). Since logistic regression does not have an equivalent to the R-squared found in linear regression, the pseudo R-square was developed to act like the R-squared, in the sense they are on a similar scale of 0 or 1 with higher values indicating a better model fit. Pseudo R-square is a relative measure of fit similar to the R-squared but cannot be substantively interpreted as the R-squared.

In ordinal regression, the main assumption is that the explanatory or independent variables have consistent or proportional effects across different levels of the "thresholds". There will be different intercept terms at each level of threshold but one slope. It is this equality of the slopes among the levels of the response variable that is regarded as the proportional odds assumption. In SPSS, it is referred to as the parallel lines assumption. The test of parallel lines examines whether the slope (location) coefficients in the model are the same across the categories of the response variable (the null hypothesis). From table 19 above, it is evident that the proportional odds assumption holds based on the significance value of the chi-square statistic (.64 >.05).

		Estimate (B)	Std. Error	Sig.	Wald	EXP_B	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[CC_Usage_Status_7 = 1.000]	-5.108	.515	.000	93.37	.006	-6.119	-4.098
	[CC_Usage_Status_7 = 2.000]	-3.648	.446	.000	66.92	.026	-4.523	-2.774
Location	[CC_Usage_Status_7 = 3.000]	-2.575	.397	.000	42.07	.076	-3.352	-1.797
	CC_CHALLENGES_9	-.597	.186	.001	10.30	.550	-.962	-.231

[Company Size=1.00]	-1.075	.451	.017	5.68	.341	-1.959	-.192
[Company Size =2.00]	-.352	.357	.324	0.97	.703	-1.052	.347
[Company Size =3.00]	0[a]	.	.	.	1	.	.
[Perceived Benefits of CC =1.00]	-.655	.416	.115	2.48	.519	-1.470	.160
[Perceived Benefits of CC =2.00]	0[a]	.	.	.	1	.	.
[Perceived Usefulness of CC =1.00]	-4.341	.753	.000	33.23	.341	-5.816	-2.865
[Perceived Usefulness of CC =2.00]	-1.902	.425	.000	20.03	.149	-2.735	-1.069
[Perceived Usefulness of CC =3.00]	0[a]	.	.	.	1	.	.
[Knowledge Level of CC =1.00]	-2.635	.529	.000	24.81	.072	-3.671	-1.599
[Knowledge Level of CC =2.00]	-1.535	.392	.000	15.33	.215	-2.303	-.767
[Knowledge Level of CC =3.00]	0[a]	.	.	.	1	.	.

a. This parameter is set to zero because it is redundant.

Table 20: Ordinal Regression: The Estimated Model of Part One Analysis.

From the table above, the Wald ratio is the basis for the test significance (Null Hypothesis: If the coefficient (estimate) is 0). It is calculated as (Estimate/Std Error)^2. As can be, the following variables are significantly different from 0. This means that there seems to be some relationships these variables and the adoption of cloud computing.

- CC_CHALLENGES_9 (p =0.01) Ward = 10.3
- Company Size=1.00 (p = 0.02) Ward = 5.68

- Perceived Usefulness of CC =1.00 (p = 0.00)   Ward = 33.23
- Perceived Usefulness of CC =2.00 (p = 0.00) Ward = 20.03
- Knowledge Level of CC =1.00 (p = 0.00)   Ward = 28.81
- Knowledge Level of CC =2.00 (p = 0.00) Ward = 15.33

In ordinal (proportional odds) model, the proportional odds are used to estimate the odds of being at a particular level of the dependent variable (low relative to high) for one-unit change in the predictor (independent) variable. Events in ordinal regression are not individual but cumulative. To explain this and interpret the estimates of the parameters in column B of Table 20 above, the cumulative odds concept needs to be discussed.

To interpret the parameters shown above, using Norusis (2007), let $P_j = P(Y \leq j)$ denote the cumulative probability of Y being at most equal to j. Where j = 1, 2, 3………. So

- $P_1 = P(Y \leq 1) = P(Y=1)$, the probability of neither using nor plan to use cloud computing service.

- $P_2 = P(Y \leq 2) = P(Y=1) + P(Y=2)$, the probability of "at most thinking of using cloud service in the future".

- $P_3 = P(Y \leq 3) = P(Y=1) + P(Y=2) + P(Y=3)$, the probability of "at most planning" to use cloud service.

Therefore, the cumulative probability $P_4 = P(Y \leq 4)$ of "at most using cloud computing" is 1.

To calculate the cumulative odds, there is need to work out the individual odds. Odds represent the probability of events occurring relative to events not occurring. And Odds can be calculated directly from proportion using the formula:

- Odds = P/(1-P)

The odds of these cumulative P1, P2, P3 probabilities are $\frac{P_1}{1-P_1}, \frac{P_2}{1-P_2}, \frac{P_3}{1-P_3}$ respectively.

From the odds, the log of odds can be derived in terms of logit functions. This expresses the natural logarithms of these odds as linear functions of the independent variables. The formula for logit functions is

- $ln\left(\frac{P}{1-P}\right) = \alpha_1 - (\beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots\dots\dots \beta_K X_K)$

The left part of the formula is the logit. It is the natural logarithms of odds that an event will occur. Coefficients in the logistic model explains the change in the logit based on the value of the independent variables. Every logit has its own α_1 value but the same β coefficients (proportional odds assumption). Using

- $ln\left(\frac{P}{1-P}\right) = \alpha_1 - \beta X$ ……………….. For one independent variable

Then substituting the above equation with respect to the regression model,

$$ln\left(\frac{p_1}{1-p_1}\right) = \alpha_1 - (\beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \dots\dots\dots \beta_8 X_8) = \alpha_1 - \beta X$$

$$ln\left(\frac{p_2}{1-p_2}\right) = \alpha_2 - (\beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \dots\dots\dots\dots \beta_8 X_8) = \alpha_2 - \beta X$$

$$ln\left(\frac{p_3}{1-p_3}\right) = \alpha_3 - (\beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \dots\dots\dots\dots \beta_8 X_8) = \alpha_3 - \beta X$$

In the above, α_1, α_2 and α_3 are the estimates of the intercepts (thresholds) shown in Table 20 column B, in the rows with the levels 1, 2, and 3 of the dependent variable. The coefficients β1, β2, β3 etc. are the (beta) estimates of the location parameters which follow in the same column. These beta coefficients are the same in all three equations but different intercept terms. This exactly denotes the proportional odds assumptions.

The continuous variables are represented by one term (see for example the unique coefficient of the factor CC_CHALLENGES_9). But the categorical variables are represented by binary (0-1) dummy variables. For example, Using Knowledge_Level_5:

- $X_{\text{Knowledge\_Level\_5=1}}$ takes value 1 if the respondents knowledge level is at level 1 (I have little/no knowledge), otherwise 0.
- $X_{\text{Knowledge\_Level\_5=2}}$ takes value 1 if the respondents knowledge is at level 2 (I have some knowledge), otherwise 0.
- The third level of the categorical variable $X_{\text{Knowledge\_Level\_5=3}}$ (I have good fundamental/expert knowledge of cloud computing) is not applicable to the same rule because it is redundant: the respondents' knowledge level of cloud computing is at level 3 if both $X_{\text{Knowledge\_Level\_5=1}}$ and $X_{\text{Knowledge\_Level\_5=2}}$ are 0.

The β coefficient of the CC_CHALLENGES_9 variable has been standardized and used in the model. Standardized beta coefficients express the impact of the independent variable in terms of standard deviation units (Jacoby, 2005). This means that the interpretation would be based on changes in standard deviation units instead of metric unit which the unstandardized coefficient uses. The interpretations are as follows:

- For challenges of Cloud Computing: A one standard deviation increase in the cloud computing challenges factor (CC_CHALLENGES_9) would yield a 0.597-unit decrease in the predicted adoption status of cloud computing, when other variables in the model are held constant. In simple terms, as the challenges increases, adoption status decreases.
- For Knowledge Level of Cloud Computing: The log of odds estimate in Knowledge_Level_of_CC =1 (I have little knowledge of cloud computing) compared to Knowledge_Level_of_CC =3 (I am an expert in CC, the reference category), is negative -2.635. In this regard, every one-unit increase in Knowledge_Level_of_CC =1 would yield to a decrease of 2.635 units in the log of odds of being in a higher level of cloud computing usage status (CC_Usage_Status_7) when other variables are constant.

In logistic regression, the best way to interpret the results is through the use of Odds Ratio (OR), specified under the EXP_B column. The OR explains how much the odds of an even occurring increases or decreases when there is a unit change associated with the independent variable. An OR value of less than 1 means the first group is less likely to experience the event compared to the reference group (McHugh, 2011).

Applying the Odds interpretation to Knowledge_Level of Cloud Computing:

1. Knowledge Level of CC =1.00 (I have No/ Little Knowledge). An OR ratio of 0.072 means that companies with Little/No knowledge of cloud computing are 0.072 less likely to adopt cloud computing (compared to those who are experts in cloud computing). To convert this to a percentage change. The formula below was used

(OR - 1) x 100 = percent increase/decrease (over the reference category) in the odds of the outcome

It can be explained that the odds of adopting cloud computing, for companies with little/no knowledge of cloud computing (relative to those who are experts in cloud computing) decreases by 93%.

2. Knowledge Level of CC =2.00 (I have some knowledge of cloud computing). An OR ratio of 0.218 indicates that companies with some knowledge of cloud computing are less likely to adopt cloud computing by 78.2% compared to those with an expert knowledge of cloud computing.

From the logit equations, one can calculate the cumulative probabilities for each level as:

$$ln\left(\frac{P}{1-P}\right) = \alpha_1 - \beta X \quad => \left(\frac{P}{1-P}\right) = e^{(\alpha_1 - \beta X)}$$

$$=> P_1 = \frac{e^{(\alpha_1 - \beta X)}}{1 + e^{\alpha_1 - \beta X)}}$$

$$P_2 = \frac{e^{(\alpha_2 - \beta X)}}{1 + e^{(\alpha_2 - \beta X)}}$$

$$P_3 = \frac{e^{\alpha_3 - \beta X)}}{1 + e^{\alpha_3 - \beta X)}}$$

Then the predicted (individual) category probabilities for the response are given by:

$P(Y=1) = p_1$

$P(Y=2) = p_2 - p_1$

$P(Y=3) = p_3 - p_2 - p_1$

$P(Y=4) = 1 - p_3 - p_2 - p_1$

Mean probabilities of values in each category of adoption status and values in each category of CC knowledge level.

Knowledge Level of Cloud Computing		Estimated Cell Probability for Response Category 1: Neither Using CC	Estimated Cell Probability for Response Category 2: Thinking of Using CC	Estimated Cell Probability for Response Category 3: Planning to Use CC	Estimated Cell Probability for Response Category 4: Using CC
I have little knowledge of CC	Mean	.5912	.2156	.1029	.0903
	N	31	31	31	31

I have some knowledge of CC	Mean	.3288	.2610	.1783	.2319
	N	67	67	67	67
I am an expert in CC	Mean	.0402	.0796	.1162	.7641
	N	110	110	110	110
Total	Mean	.2153	.1583	.1342	.4922
	N	208	208	208	208

Table 21: Mean Probability of Categories of Adoption Status and Knowledge Level of Cloud Computing.

The means of the individual probabilities are given in the table above for the levels of the categorical independent variable (knowledge level of cloud computing) used in the model. The mean estimated probability of using cloud computing (response category 4) for those who have little knowledge of cloud computing is 9%, it rises to 23% for those who have some knowledge of cloud computing. But for those who are experts in cloud computing, it sharply reaches a maximum of 76%. On the other hand, the mean probability of neither using nor planning to use cloud computing for those who have little knowledge of cloud computing is high (59%), for those who have some knowledge of cloud computing, it drops sharply to 33% and for those who are experts in cloud computing, it reaches the minimum of 4%. The sharp changes from little knowledge to some knowledge to experts in CC are due to the strong effect indicated by their corresponding coefficients.

The probabilities for each category of adoption status as functions of the CC_Challenges factor and knowledge level of cloud computing are shown in Figure 8 below. There are 3 curves in each case, because these probabilities differ according to the knowledge level of cloud computing. In all plots, high values in the factor (CC_Challenges) means strong agreement to the challenges of cloud computing.

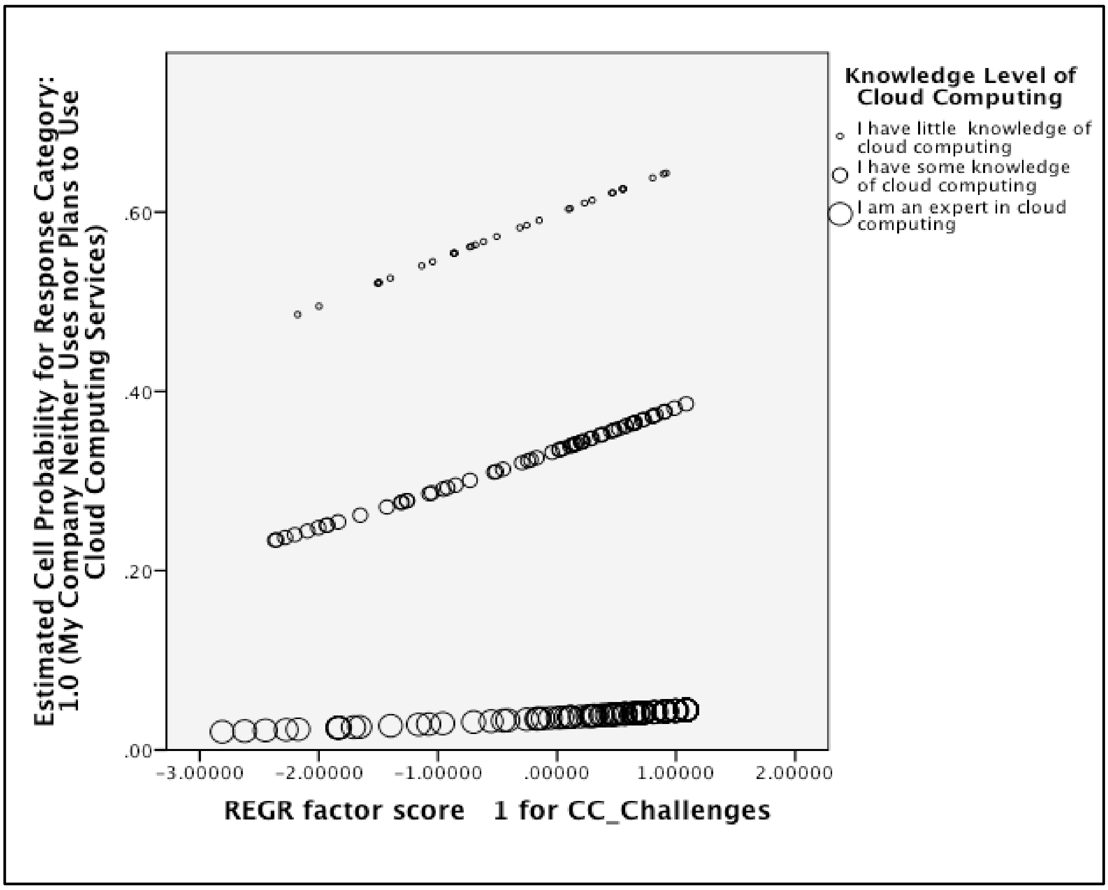

Figure 8: Estimated Cell Probability for Response Category 1

From the figure above, the probability of neither using nor planning to use cloud computing increases with higher concerns for the challenges of cloud computing regardless of the knowledge level of cloud computing.

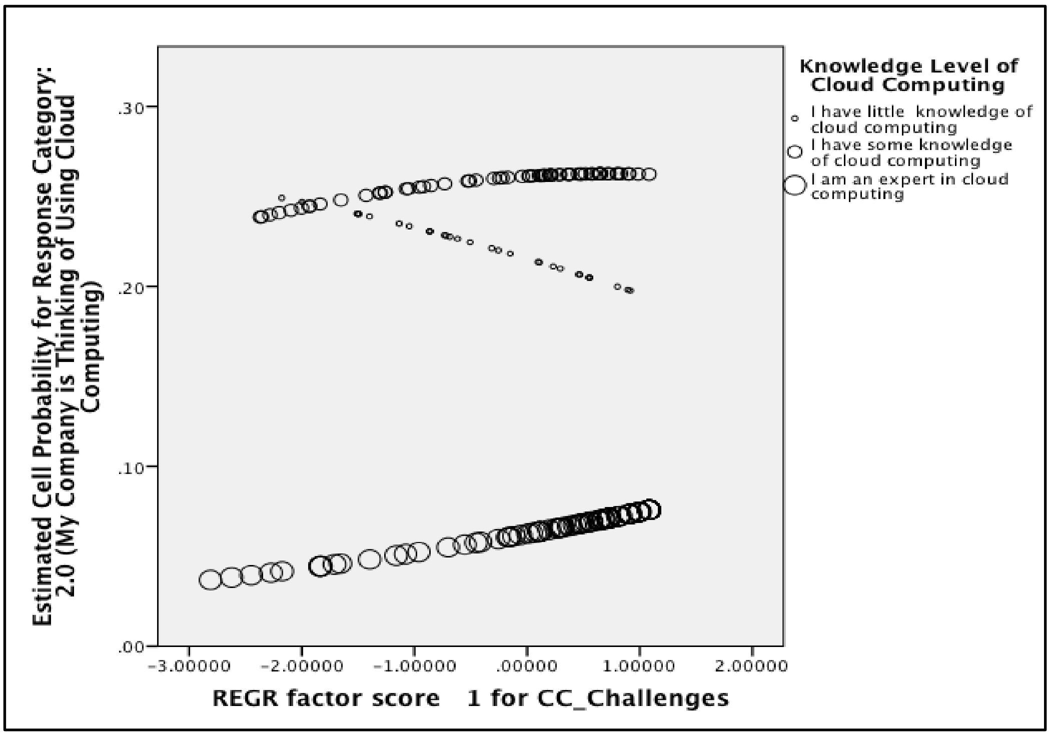

Figure 9: Estimated Cell Probability for Response Category 2

In the figure above, the probability of thinking of adopting cloud computing increases as the challenges of cloud computing increases for those who are experts in cloud computing. This is similar to those with some knowledge of cloud computing. Conversely, the probability of thinking of adopting cloud-computing decreases as concern about the challenges of cloud computing increases, for those who have little knowledge of cloud computing.

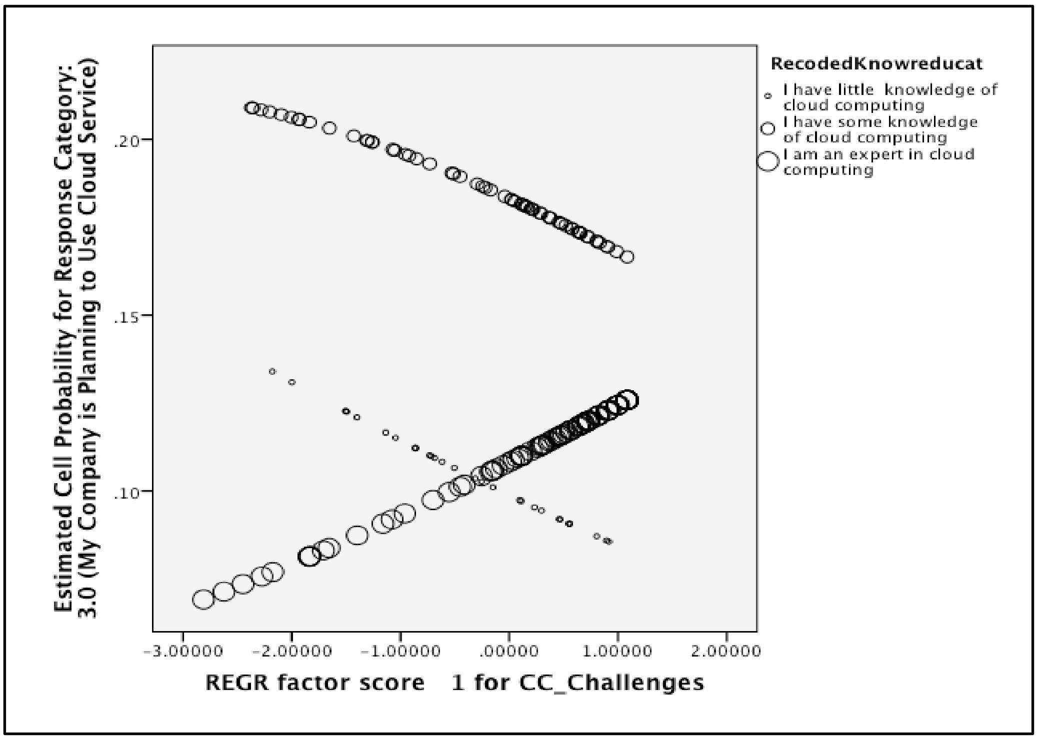

Figure 10: Estimated Cell Probability for Response Category 3

In the above figure, the probability of planning to adopt cloud computing for those who are experts in cloud computing increases as challenges of cloud computing increases. But for those with little knowledge and those with some knowledge of cloud computing, the probability of planning to adopt cloud computing decreases as the challenges increases.

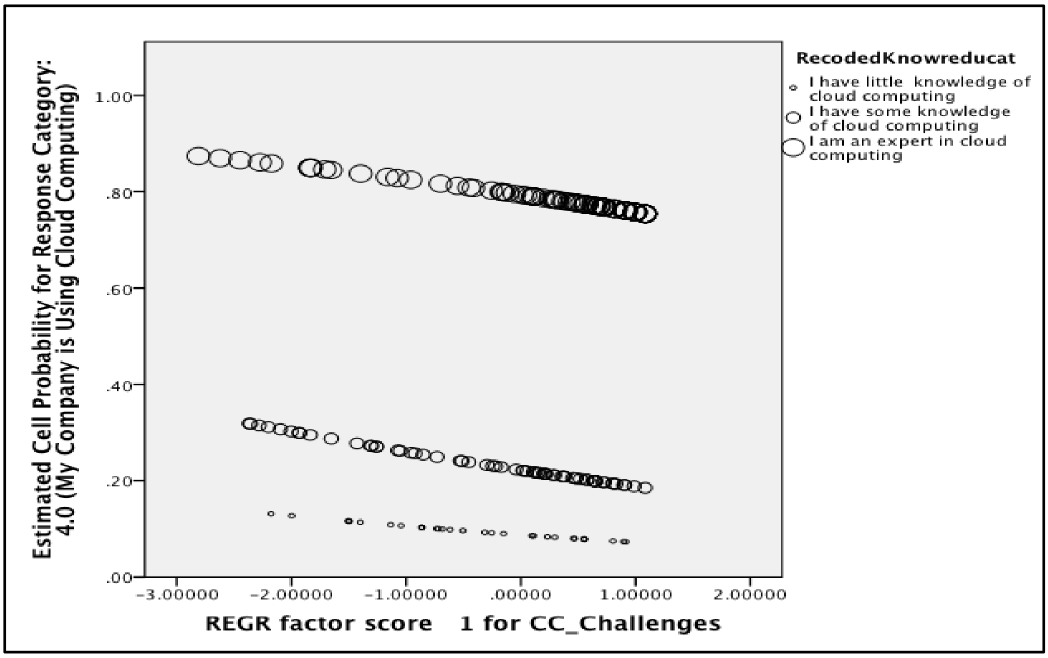

Figure 11: Estimated Cell Probability for Response Category 4

This figure suggests that the higher the concerns for challenges of cloud computing, the lower the usage of cloud computing regardless of the knowledge level of cloud computing.

In all the figures above, it can be concluded that those who are already using cloud computing, know the reality of the effect of the challenges of cloud computing. From figure (8), being that the probability of neither using nor planning to use cloud computing increases as concerns increases, it means that adoption will continue to be an issue with the continued existence of the challenges of cloud computing.

7.1.7 CONCLUSION OF PART ONE

The analysis in this section showed that there is enough evidence in support of the following:

- The correlation tests between all predictors used for the final model in the first part of the analysis shows that the concerns about the challenges of cloud computing are positively associated with the knowledge level of cloud computing as well as its perceived benefits and usefulness. This means that the more people know about and use cloud computing, the more they worry about its challenges.
- The regression analysis in part one shows that the usage status of cloud computing depends on the knowledge level of cloud computing as well as its challenges, while controlling for perceived cloud computing benefits, usefulness and company size. Those who are already using cloud computing have the experience of cloud computing challenges compared to those thinking or planning to use cloud computing. Also, non-adoption of cloud computing increases as the challenges increases.

7.2 PART TW0

In this section, a detailed description of each variable used in part two of the analysis is given. Since all variables used in the analysis are categorical (ordinal) in nature, the frequencies and valid percentages have been reported. These are illustrated in the table below:

7.2.1 DESCRIPTIVE STATISTICS

Descriptive Statistics of Variables Used in Part Two of Data Analysis		
Variable	Frequency	Valid Percent

Dependent Variable **Perceived Usefulness of Cloud Computing (Q.8)**		
(1) Not Useful	23	10.6
(2) Less Useful	26	11.9
(3) Useful	82	37.7
(4) Very Useful	87	39.9
TOTAL	218	100
Independent Variables		
(Q.20.1) My CSP will always stick/conform to their SLA.	Frequency	Valid Percent
(1) Strongly Disagree	40	39.2
(2) Disagree	17	16.7
(3) Neither Agree nor Disagree	11	10.8
(4) Agree	24	23.5
(5) Strongly Agree	10	9.8
(Q.20.2) My CSP behaves in a consistent manner.		
(1) Strongly Disagree	38	37.3
(2) Disagree	19	18.6
(3) Neither Agree nor Disagree	12	11.8
(4) Agree	24	23.5
(5) Strongly Agree	9	8.8
(Q.20.3) My CSP's attitude to service delivery seems to be governed by sound principles.		
(1) Strongly Disagree	44	43.1

(2) Disagree	12	11.8
(3) Neither Agree nor Disagree	12	11.8
(4) Agree	25	24.5
(5) Strongly Agree	9	8.8
(Q.20.4) My CSP seems to have a good sense of fairness.		
(1) Strongly Disagree	40	39.2
(2) Disagree	14	13.7
(3) Neither Agree nor Disagree	17	16.7
(4) Agree	17	16.7
(5) Strongly Agree	14	13.7
(Q.20.5) My CSP is very capable in their service delivery.		
(1) Strongly Disagree	44	43.1
(2) Disagree	12	11.8
(3) Neither Agree nor Disagree	14	13.7
(4) Agree	21	20.6
(5) Strongly Agree	11	10.8
(Q.20.5) My CSP is very capable in their service delivery.		
(1) Strongly Disagree	44	43.1
(2) Disagree	12	11.8
(3) Neither Agree nor Disagree	14	13.7
(4) Agree	21	20.6

(5) Strongly Agree	11	10.8
(Q.20.6) My CSP is known to be a successful provider.		
(1) Strongly Disagree	47	46.1
(2) Disagree	13	12.7
(3) Neither Agree nor Disagree	9	8.8
(4) Agree	22	21.6
(5) Strongly Agree	11	10.8
(Q.20.7) I feel confident about the skills of my CSP.		
(1) Strongly Disagree	47	46.1
(2) Disagree	15	14.7
(3) Neither Agree nor Disagree	10	9.8
(4) Agree	17	16.7
(5) Strongly Agree	13	12.7
(Q.20.8) My CSP has specialised capabilities that can increase our performance		
(1) Strongly Disagree	49	48.0
(2) Disagree	13	12.7
(3) Neither Agree nor Disagree	14	13.7
(4) Agree	18	17.6
(5) Strongly Agree	8	7.8
(Q.20.9) My CSP appears to be very knowledgeable about the work they do		

(1) Strongly Disagree	42	41.2
(2) Disagree	14	13.7
(3) Neither Agree nor Disagree	16	15.7
(4) Agree	21	20.6
(5) Strongly Agree	9	8.8
(Q.20.10) My CSP is very concerned about our cloud computing needs and requirements		
(1) Strongly Disagree	45	44.1
(2) Disagree	15	14.7
(3) Neither Agree nor Disagree	11	10.8
(4) Agree	26	25.5
(5) Strongly Agree	5	4.9
(Q.20.11) My CSP really looks out for, and informs us of, services that are important to us.		
(1) Strongly Disagree	49	48.0
(2) Disagree	10	9.8
(3) Neither Agree nor Disagree	9	8.8
(4) Agree	25	24.5
(5) Strongly Agree	9	8.8
(Q.20.12) My CSP will go out of their way in wanting to satisfy our needs and expectations by offering exceptional customer services		
(1) Strongly Disagree	47	46.1

(2) Disagree	11	10.8
(3) Neither Agree nor Disagree	15	14.7
(4) Agree	22	21.6
(5) Strongly Agree	7	6.9
(Q.20.13) My CSP would not knowingly do anything that can harm our business relationship.		
(1) Strongly Disagree	45	44.1
(2) Disagree	14	13.7
(3) Neither Agree nor Disagree	11	10.8
(4) Agree	21	20.6
(5) Strongly Agree	11	10.8
TOTAL NUMBER OF RESPONSES FOR Q.20.1 TO 20.13	102	100
Control Variable		
Reliability of the Cloud Service Provider (Q.15.6)	Frequency	Valid Percent
(1) Extremely Unimportant	1	0.6
(2) Unimportant	3	1.9
(3) Neither Important nor Unimportant	14	8.6
(4) Important	48	29.6
(5) Extremely Important	96	59.3
TOTAL	162	100

Table 22: Descriptive Statistics of Variables Used in Part Two of the Data Analysis.

7.2.1.1 PERCEIVED USEFULNESS OF CLOUD COMPUTING (Q.8)

Survey question 8 was designed to ask the respondents about their perceived usefulness of cloud computing. As shown in table above, majority of the survey respondents indicated that cloud computing technology is very useful (39.9%) while 37.7% said it is useful. On the contrary, 11.9% said that cloud computing technology is less useful while the remaining 10.6% said that the technology is not useful. Further analysis will reveal whether trusting the cloud service provider has any influence on the respondents' perceived usefulness of cloud computing.

7.2.1.2 RELIABILITY OF THE CLOUD SERVICE PROVIDER (Q.15).

This question was used as a control variable in this part of data analysis. The frequency table above clearly shows that the respondents put particular emphasis on the reliability of cloud computing provider as an essential criterion for choosing a cloud service provider. More than half (59.3%) of the survey respondents considered reliability as extremely important and about 29.6% said it is important. 8.6% said it is neither important nor unimportant, 1.9% said it is unimportant while the remaining 0.6% indicated extremely unimportant.

7.2.1.3 TRUST OF CLOUD SERVICE PROVIDER

In order to measure the trust level of CSPs trust by their clients, question 20 was created. Trust in this aspect was measured using 3 dimensions (ability, integrity and benevolence). These dimensions are referred to as factors of perceived trustworthiness or propensity to trust (Mayer, Davis and Schoorman, 1995). The questions in this scale were separated in sub-groups corresponding to the three dimensions of trust.

A total of 13 questions were created to measure trust using these three dimensions. Questions 20.1 – 20.4 were designed to measure integrity, 20.5 – 20.9 were designed for ability, while questions 20.10 – 20.13 were measures of benevolence. The distributions of responses in these 13 variables shows negative attitudes, i.e. many respondents do not trust their cloud computing providers. The statements were constructed with positive wordings but majority of the respondents indicated in the categories 'Strongly disagree' or 'Disagree'.

7.2.2 RELIABILITY TEST OF ALL VARIABLES MEASURING TRUST OF CSP (QUESTION 20.1 TO 20.13).

The detailed reliability analysis shows high correlations between the items in the trust scale. As shown below, a Cronbach's alpha value of .970 indicates that all items in the trust scale have very high internal consistency.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.970	.970	13

Table 23: Reliability Statistics of all Trust Items (20.1 – 20.13

Item-Total Statistics

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
My CSP will always stick/conform to their SLA (Q.20.1)	.850	.967
My CSP behaves in a consistent manner (Q.20.2)	.875	.966
My CSP's attitude to service delivery seems to be governed by sound principles (Q.20.3)	.814	.968
My CSP seems to have a good sense of fairness (Q.20.4)	.789	.968
My CSP is very capable in their service delivery (Q.20.5)	.835	.967
My CSP is known to be a successful provider (Q.20.6)	.890	.966
I feel confident about the skills of my CSP (Q.20.7)	.814	.968
My CSP has specialised capabilities that can increase our performance (Q.20.8)	.854	.967
My CSP appears to be very knowledgeable about the work they do (Q.20.9)	.870	.967
My CSP is very concerned about our cloud computing needs and requirements (Q.20.10)	.835	.967
My CSP really looks out for, and informs us of, services that are important to us (Q.20.11)	.782	.969

My CSP will go out of their way in wanting to satisfy our needs and expectations by offering exceptional customer services (Q.20.12)	.770	.969
My CSP would not knowingly do anything that can harm our business relationship (Q.20.13)	.822	.968

Table 24: Item-total Statistics for the Reliability Test of Q20.1 – 20.13.

As shown in table 23 above, there is no item whose deletion would lead to an increase in the Cronbach's Alpha value of .970. Factor analysis can further be used to reduce the dimensionality of these set of questions, in the preparation for the regression modelling. Again, each item appears to have a very strong positive correlation with the composite scores of the rest 12 items.

7.2.3 FURTHER RECODING AND DIMENSIONALITY REDUCTION.

In the following, the control variable (reliability of service provider) was tested separately against the corresponding dependent variable (perceived usefulness of cloud computing). This was done to examine the significance of including this variable into further analysis.

Cross-tabulation between the dependent variable (perceived usefulness of cloud computing) and the independent variable (reliability of the CSP) showed that the latter had some cells with few observations. These few counts were in categories 1 (Extremely Unimportant), 2 (Unimportant) and 3(neither important nor unimportant). As a result, this control variable was recoded into 3 categories. These three categories having very few counts were merged together. The resulting variable was recoded as "Up to neutral", "Important" and "Extremely Important". Then its association with the dependent variable was tested again. The association was found significant ($X2(6) = 27.8$, $p < .001$). Therefore, the variable was retained for inclusion in the regression model.

7.2.4 FACTOR ANALYSIS

Similar to the factor analysis conducted in section 7.1.4, another factor analysis was conducted using all the 13 questions (Questions Q20.1 to Q20.13) measuring the trust of cloud service providers.

- Integrity: Questions 20.1-20.4
- Ability: Questions 20.5-20.9

- Benevolence: Questions 20.10-20.13

As in the previous application of factor analysis, an EFA was conducted with these 13 questions which were all in the scale of 1-5, with 1= “Strongly Disagree” and 5=” Strongly Agree”. Principal Components with the Kaiser’s criterion was used and one-factor was extracted. This extracted factor explained 73.6% of the total variance. The factor was named ALL_TRUST_ITEMS_20 for reference purpose. The proportion of variance explained is considered very good (refer to section 7.1.4). The scree-plot also suggested the extraction of one factor only.

With regard to the diagnostics of the analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was 0.95. This figure is characterised as “marvellous” (Hair, et.al, 1995; Kaiser and Rice, 1974). The Bartlett’s Test of Sphericity gave an approximate chi-square statistic of 1395.7 (with 78 degrees of freedom), rejecting the null hypothesis of the correlation matrix being the identity matrix (with p-value practically zero). The correlation among the 13 variables was most significant.

Component Matrix[a]

	ALL_TRUST_ITEMS_20
	1
My CSP will always stick/conform to their SLA (Q.20.1)	.876
My CSP behaves in a consistent manner (Q.20.2)	.896
My CSP’s attitude to service delivery seems to be governed by sound principles (Q.20.3)	.843
My CSP seems to have a good sense of fairness (Q.20.4)	.821
My CSP is very capable in their service delivery (Q.20.5)	.860
My CSP is known to be a successful provider (Q.20.6)	.909
I feel confident about the skills of my CSP (Q.20.7)	.844
My CSP has specialised capabilities that can increase our performance (Q.20.8)	.878
My CSP appears to be very knowledgeable about the work they do (Q.20.9)	.892

My CSP is very concerned about our cloud computing needs and requirements (Q.20.10)	.861
My CSP really looks out for, and informs us of, services that are important to us (Q.20.11)	.813
My CSP will go out of their way in wanting to satisfy our needs and expectations by offering exceptional customer services (Q.20.12)	.803
My CSP would not knowingly do anything that can harm our business relationship (Q.20.13)	.850

Table 25: Component Loadings of All Items Relating to Trust of Cloud Service Providers.

The table above presents the component loadings of all items in the scale of question 20. These are simply the correlations between variables and the extracted component. Since correlations ranges from -1 to +1, all the variables have very strong positive correlation with the extracted component. As a result, the extracted factor was retained for further analysis.

7.2.5 REGRESSION MODEL

7.2.5.1 HYPOTHESIS 3

In this section, an ordinal regression analysis was conducted to test hypotheses 3. The dependent variable was the perceived usefulness of cloud computing and the independent variable was the trust of cloud service provider (ALL_TRUST_ITEMS_20, the factor extracted from factor analysis above). The control variable was reliability of cloud service provider.

As an ordinal dependent variable, values were assigned 1= if cloud computing is perceived as not useful, 2 = less useful and 3 = very useful. This variable shows a natural ordering in its categories, although this is a ranking order only and not one which allows any arithmetic distance.

Prior to conducting the ordinal regression analysis, all assumptions (highlighted in section 7.1.6) were tested and met. Since this regression analysis had only one control and one independent variable, these two variables were checked for multicollinearity between them. They met the maximum threshold of <5 for VIF and >0.2 for tolerance (Rogerson, 2014). There was no issue of multicollinearity between them.

The table below is an example of multicollinearity test between the independent and the control (ALL_TRUST_ITEMS_20 and reliability of the service provider) variables, using the ALL_TRUST_ITEMS_20 as the dependent variable.

Coefficients[a]

Model	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
Reliability of the Service Provider (Q.15.6)	1.000	1.000

a. Dependent Variable: REGR factor score_ ALL_TRUST_ITEMS_20

Table 26: Collinearity Test Example

The first model was estimated using only the control variable and the dependent variable. In order to check for improvement or robustness of the model, a final model was estimated by adding "ALL_TRUST_ITEMS_20" as independent variable. The significance value (p = 0.25) explains that the final model gives a significant improvement over the baseline intercept only model. The Pseudo R-Squared value was also improved (Nagelkerke Pseudo R- square from .116 to .119). Although, its interpretation is very subjective (see section 7.1.6). Finally, the significant figure of p = .22 indicates that the proportional odds assumption was met.

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	131.193			
Final	121.830	9.363	3	.025
Pseudo R-Square				
Cox and Snell	.088			
Nagelkerke	.119			

McFadden	.069			
Test of Parallel Lines				
Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Null Hypothesis	121.830			
General	117.431	4.399	3	.221

Link function: Logit.

Table 27: Ordinal Regression Statistics for Part Two Analysis

The results of the final regression model are as follows.

		Estimate (B)	Std. Error	Wald	Sig.	EXP_B	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Perceived Usefulness of Cloud Computing Services = 1.00]	-5.070	1.031	24.18	.000	.006	-7.091	-3.048
	[Perceived Usefulness of Cloud Computing Services = 2.00]	-1.035	.274	14.27	.000	.355	-1.571	-.499
Location	ALL_TRUST_ITEMS_20"	-.467	.227	4.23	.039	.637	-.912	-.023
	[Reliability of Cloud Service Provider=1.00]	-2.118	1.003	4.46	.035	.120	-4.084	-.152
	[Reliability of Cloud Service Provider =2.00]	-.428	.516	0.69	.408	.652	-1.440	.585

[Reliability of Cloud Service Provider =3.00]	0^b	.	.	.	1	.	.

Table 28: Ordinal Regression Results (Part Two).

From the equations regarding the interpretation of the coefficients of ordinal regression given in the previous model, the findings here are as follows:

The β coefficients of the "ALL_TRUST_ITEMS_20" (Trust of the CSP) variable have been standardized and used in the model. Standardized beta coefficients express the impact of the independent variable in terms of standard deviation units. This means that the interpretation would be based on changes in standard deviation units instead of metric unit, which the unstandardized coefficient uses.

- For Trust of the CSP: A one standard deviation increase in the trust factor (ALL_TRUST_ITEMS_20") would yield a 0.47 unit decrease in the predicted perceived usefulness of cloud service, when other variables in the model are held constant.
- For the Reliability of the Cloud Computing Provider: The log of odds estimate in Reliability of CSP =1 (Neither important nor unimportant) compared to Reliability of CSP = 3 (Extremely important, the reference category), is negative, -2.118. This means that the log of odds of being in a higher level of perceived usefulness of cloud computing decreases by 2.118 units. The same applies to the estimate of Reliability of CSP = 2 (Important) but to a lesser degree. This last coefficient however is not significant (p = 0.4), therefore a conclusion cannot be drawn that there is actual difference between the options 'Important and Extremely Important'. This can also be seen from the 95% confidence interval (upper bound) which extends well into a positive value.

Mean probabilities of values in each category of perceived usefulness of cloud computing and values in each category of reliability of service provider.

Reliability of CSP		Estimated Cell Probability for Response Category 1: Not Useful	Estimated Cell Probability for Response Category 2: Useful	Estimated Cell Probability for Response Category 3: Very Useful
Up to neutral	Mean	.1050	.7304	.1646
	N	18	18	18
Important	Mean	.0416	.6109	.3475
	N	48	48	48
Extremely important	Mean	.0125	.3410	.6466
	N	96	96	96
Total	Mean	.0314	.4642	.5044
	N	162	162	162

Table 29: Individual Probabilities of Perceived Usefulness of Cloud Computing and the Reliability of Cloud Computing Provider.

From the table above, it is evident that the probability of perceiving cloud computing as very useful (response category 3) increases from 0.2 for those who do not consider the reliability of the cloud service provider important (up to neutral), to 0.6 for those who consider reliability of cloud service provider as extremely important. Conversely, those in the up to neutral category have the highest probability (0.1) of perceiving cloud computing as not useful (response category 1). This decreases to 0.01 for those who consider the reliability of the cloud computing provider as extremely important.

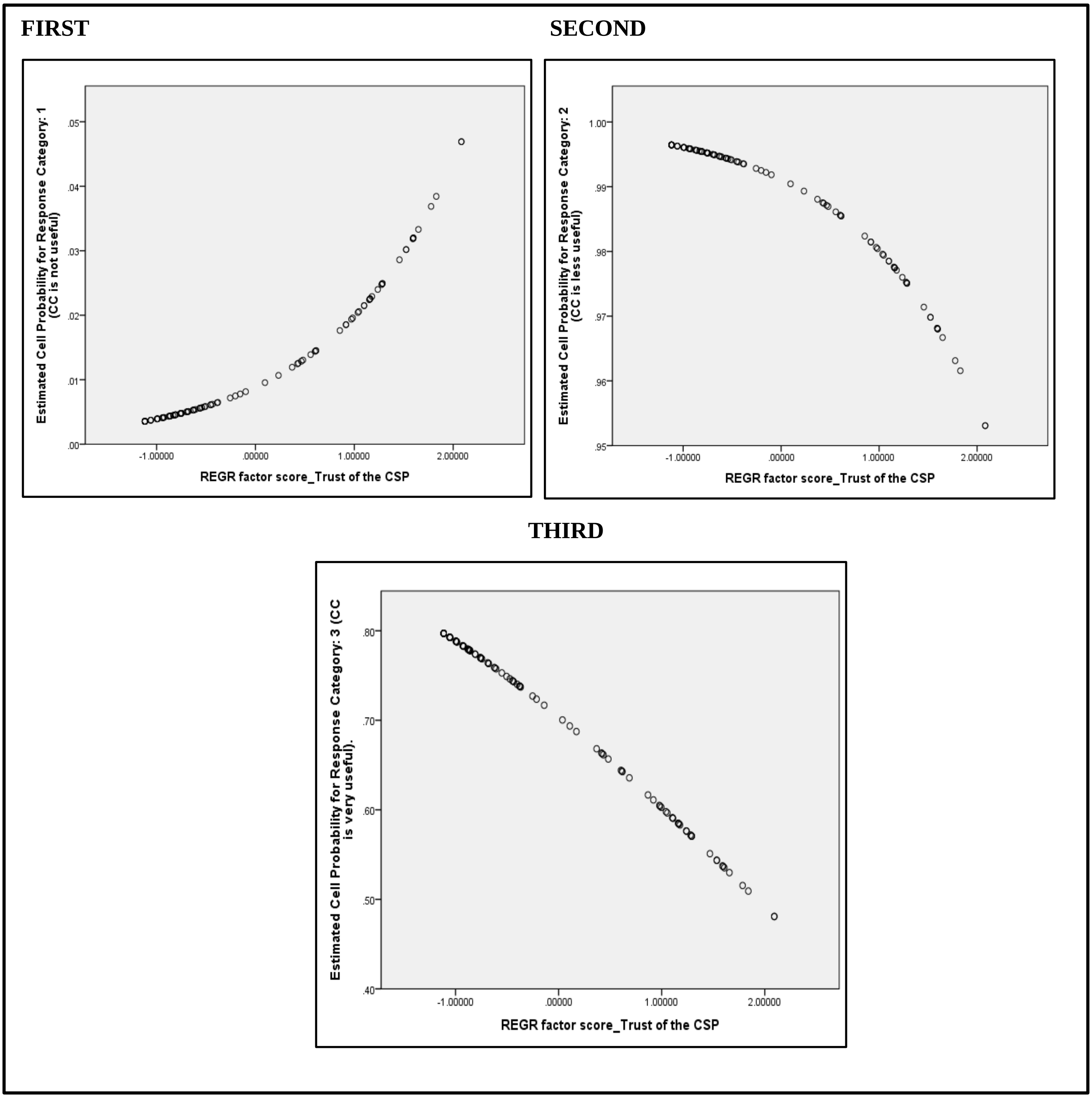

Figure 12: The Probabilities for Each Category of Perceived Usefulness of Cloud Computing as Functions of the Trust factor.

7.3 CHAPTER SUMMARY

In this study, the data analysis was done using SPSS. It involved two parts. The first part was done to test hypothesis 1 and 2. In these hypotheses, the dependent variable was cloud computing adoption status, the independent variables were knowledge level of cloud computing and the challenges of cloud computing. The control variables used were company size, perceived benefits of cloud computing and perceived usefulness of cloud computing. In part two (done to test hypothesis 3), the dependent variable was perceived usefulness of cloud computing, independent variable was trust in CSPs while the reliability of the CSP was used as a control variable. Each part of the analysis was started with a description of the variables used. A reliability test was done for each parts of the analysis and all multi-scale items used in the analysis indicated strong internal consistencies. Before carrying out the regression analysis for both parts of the analysis, an EFA and CFA tests were carried out. The EFA results for both parts of the analysis produced one-factor solution with all variables having strong positive correlations with the extracted factors. A CFA tests also produced one dominant factor for each of the scales used in each part of the analysis. The two scales were empirically distinct and discriminant validity was thus supported. Finally, a regression analysis was carried out in both parts of the analysis. The final results showed that cloud computing is influenced by the knowledge level and challenges of cloud computing (hypothesis 1 and 2 supported). Although, trust was found to have a negative correlation with the perceived usefulness of cloud computing, hence hypothesis 3 was not supported. It was concluded that a positive adoption decision could be influence by either trust or perceived usefulness and as such, they are seen as substitutes.

CHAPTER 8

DISCUSSION

The study carried out by Gartner in 2013 revealed that the global IT executives considered cloud computing technology to be one of the top five most valuable technologies. Cloud computing is used by SMEs because it provides them with an affordable and easier access to IT related resources (Kin, et al., 2012). Despite this benefit, Kim et al. argued that the problems faced in the adoption of cloud computing by smaller organisations are not the same with those of their larger counterparts. The main problems faced by larger organisations in cloud adoption relate to technical issues, operational and organisational issues (Alsanea, 2015). The report presented by Cloud Industry Forum (2014), suggested an increase in the adoption rate of cloud computing by business organisations, with larger organisations appearing to have adopted more than their smaller counterparts. Adoption of cloud computing among UK SMEs is still very slow. As reported by Tyler and Hurley (2011), the survey of 1600 companies by VMware revealed that only 48% of UK SMEs have adopted cloud computing compared to the average 60% across Europe.

While the works of Giannakouris and Smihily (2014) and Tehrani (2013) suggest that insufficient knowledge of cloud computing was a barrier to SMEs' adoption of cloud computing, Alshmaila and Papagiannidis (2013) found that company size was an influential factor in cloud adoption by SME. Uusitalo, et al. (2010) found lack of privacy and reliability of the service provider as barriers to cloud adoption by SMEs. The 2011 cloud computing survey by Cloud Industry Forum revealed that long-term contract lock-in, weak service level agreement (SLAs), lack of confidentiality, accountability and transparency were major challenges hindering the adoption of cloud services by UK businesses (see section 3.3). Meanwhile, some other authors revealed that trust is a very significant factor for cloud computing usage and adoption (please see Huang and Nicol, 2013; Khan and Malluhi, 2010; Pearson and Bernameur, 2010; Chung and Hermans, 2010; and Li and Ping, 2009).

Being an important ICT innovation, cloud computing has been reported to offer many benefits to SMEs. To see significant rates of adoption among these SMEs, there is a need to understand the process of adopting cloud computing and the role of trust in its usage and adoption. Using the DOI, TOE and IMOT frameworks as theoretical foundations, this study developed and validated a research model which explains the entire process of cloud usage and adoption. In this model, several influential factors of cloud adoption by SMEs were proposed.

8.1 A REFLECTION ON RESEARCH OBJACTIVES AND HYPOTHESES

This study obtained key findings and implications regarding the factors that encourage or inhibit the adoption and usage of cloud computing by SMEs (Objective 1). Ideally, new technologies are expected to add values and offer significant benefits to a company, well beyond those offered by the already existing ones (Alshmaila and Papagiannidis (2013). The adoption of a new technology can be delayed sometimes because of various reasons. For example, lack of awareness of the benefits of the technology, knowledge level of the technology or the challenges that come with the technology. This study revealed that these factors are applicable to cloud computing and they are essential when considering cloud computing adoption. Also, their relationships with cloud computing adoption were examined (Objectives 2). The benefits and challenges of cloud computing were explored in section 2.3 and 2.4.

The main focus of this study was to research into the role of trust in the adoption and usage of cloud computing by SMEs (Objective 3). This was met by reviewing relevant literature regarding trust issues with cloud adoption which relate to the cloud service provider. These issues have been reported as lack of privacy, lack of security, lack of confidentiality, loss of control of service, malicious insider, SLA issues etc. These issues have been widely discussed by many researchers who suggested that they could lead to issue of trust in service providers.

A model was developed in this research to study the adoption process and usage of cloud computing (Objective 4). This model was developed based on the TOE, DOI and IMOT models. The TOE and DOI have received considerable attention in studying technology and innovation acceptance. The IMOT has also been widely used in studies relating to trust in the organisational settings. (Please refer to sections 3.5.1 and 4.2 on full details about these models and chapter 5 on the research model). The model was validated using a randomly selected sample of SMEs in the UK to provide answers to an online survey. Data was analysed to test hypothesis 1, 2 and 3.

The findings reported in this thesis provided empirical support for hypothesis 1, which states state that 'the higher the awareness of cloud computing challenges, the lesser the chances of adoption. As expected, this hypothesis was supported. It was found that as a clients' awareness about the challenges of cloud computing increase, their chances of adoption reduce. This result supports the findings of other researchers in this field (Alsanea, 2015; Carcary, Doherty and

Conway, 2015; Nussbaumer and Liu, 2013; Cloud Industry Forum, 2013; Bradshaw, et al., 2012; Sahandi, Alkhalil and Opara-Martins, 2012; Aberer, et al., 2012; Chung and Hermans, 2010 and Uusitalo, et al., 2010). In this research, the challenges of cloud computing are attributed to those that relate more to the cloud service providers. These are cost and difficulty of migration, lack of privacy, lack of availability of data, lack of data integrity, loss of control of service, malicious insider and service level agreement issues.

The results also provided an empirical support for hypothesis 2. In this regard, the higher the knowledge level of cloud computing, the higher the chances of adoption. The result of this study did show that an increase in the knowledge level of cloud computing increased the chances of adoption. This was expected because the more people know about cloud computing the more its chances of being adopted. As also expected, the respondents whose companies have already adopted cloud computing indicated that they were either experts in cloud computing or they had good fundamental knowledge of cloud computing This study supports the findings of those presented by Giannakouris and Smihily, 2014; Tehrani and Shirazi, 2014; Gollakota and Doshi, 2011 and Thong, 1999.

In hypothesis 3, the result was counter-intuitive because it was expected that the probability of perceiving cloud computing as very useful should increase when trust in CSP increases. But the findings failed to provide support for this statement. Instead it revealed that the probability of perceiving cloud computing as very useful decreases as trust increases. This negative association was further investigated and it was found that a good number of the respondents indicated that cloud computing is very useful but mentioned a complete disagreement to the trust they have on their CSPs. In addition to this, trust was negatively correlated with the perceived usefulness of cloud computing, which means that a positive adoption decision could be influenced by either trust of the service providers or the perceived usefulness of cloud computing. As a result, it was concluded that trust and perceived usefulness of cloud computing are substitutes.

The five main variables (CC challenges, knowledge level of CC, trust in CSP, perceived usefulness of CC and adoption status of CC) of this research were derived from the model to better explain the research context. Again the concept of trust was modelled using three dimensions (ability, integrity and benevolence) as the major attributes of the CSPs' trustworthiness. Inferences drawn from literature and findings from this research survey suggest that conformity to SLA, capability and consistency in service delivery, service knowledge, good reputation and excellent customer services are essential requirements that demonstrate such attributes of trustworthiness. Although previous literature presented various factors that influence adoption and provisioning/use of cloud computing, in line with these, this study focused more on the clients' perceptions about the trust of their service provider. This study suggests that cloud computing adoption by SMEs is determined by knowledge level of the technology and its perceived usefulness. Adoption of cloud computing also depends on the level of challenges involved. Again, trust plays a very important role in this context. This study reports that cloud computing is perceived as being useful but trusting the service provider is still of great concern. Therefore, trust may be a very significant factor in the adoption as well as usage of cloud services but this needs further investigation.

8.2 SIGNIFICANT CONTRIBUTIONS

The findings from this study have both theoretical and practical contributions.

8.2.1 THEORETICAL CONTRIBUTIONS

The first contribution of this research is linked to the development of a step-by-step model that will guide SMEs in their decision to adopt cloud computing. Based on an extensive review of related literature, this model was developed to allow a new perspective of the conflicting evidence from previous studies on factors of cloud computing adoption. There is hardly any model of cloud adoption by SME that integrated trust with many other influential factors of cloud adoption. Based on the recommendation of Carcary, Doherty and Conway (2013), this SME-specific model was designed to emphasize the preparatory steps, supports and guidelines for efficient cloud computing migration by SMEs. It also provides a strategy for selecting a CSP and includes a review process. This model not only relate to the adoption process of cloud computing but includes a guideline for post-adoption management.

The second contribution was the investigation of several factors that influence the adoption and usefulness of cloud computing. A number of individual variables (e.g cloud computing benefits, knowledge level, company size, perceived usefulness and reliability of service provider) as well as grouped variables (those measuring cloud computing challenges and trust) were identified. These variables were further examined to check for significant relationship with the adoption and perceived usefulness of cloud computing.

This study contributes to the growing literature of innovation/ICT adoption and most specifically cloud computing adoption. Although, its main focus relates to the role of trust in cloud computing usage and adoption, with an exploration of other influential factors. However, insights from this study can also be used to study the adoption process of other innovations.

The model developed in this research is theoretically grounded in the DOI, TOE and IMOT frameworks. It was validated by examining the influence of variables such as knowledge level, cloud computing challenges and trust of CSP, on the adoption and perceived usefulness of cloud computing. This model builds on existing theories/models of information technology and innovation adoption, which suggest that many factors influence the decision to adopt innovations.

Interestingly, this study is among the first studies that focused on the concept of trust in the adoption process of cloud computing by SMEs (in relation to the CSP). Despite the fact that this study was carried out in the UK using SMEs from all its four regions, the results cannot be generalised to all SMEs worldwide. This is because different countries have different policies and different SMEs be they from the same sector, share different views. Also as explained previously, the rate of adoption of cloud computing by UK SMEs is different from those of other countries. The top ranking challenges of cloud adoption reported in this study many not be top ranking in many other regions.

One uniqueness of this study is that it considers both pre-adoption and post-adoption perspectives which previous studies (e.g Tehrani and Shirazi, 2014; Sahandi, Alkhalil and Opara-Martins, 2014 and Carcary, Doherty and Conway, 2013) did not consider. It also considers the selection process of CSPs (based on certain attributes) as well as a review process at each stage of the adoption process. Most studies in this area (e.g Low, Chen and Wu, 2011; Rogers 2003; Moore and Benbasat, 1991) mainly looked at the pre-adoption factors with a main focus on either technological or organisational factors.

This research incorporated technological, organisational, environmental, individual and trust perspectives to explain the adoption process of cloud computing by SMEs. It fulfils the recommendation given by Zhu and Kraemer (2005), who suggested the need for integrating theories such as the DOI and TOE frameworks to study the diffusion of a technology. This study initially started with a review of literature relating to the concept of cloud computing, the benefits and challenges of cloud computing with a focus on business organisations. When it was discovered that out of all the business sizes, the SMEs were more sceptical in adopting cloud computing despite its benefits, then the study was narrowed down to SMEs by focussing more on trust and other factors that influence their uptake of cloud computing. Most of these factors were empirically tested by previous studies, to assess their relationship on the adoption of technological innovations.

Following these reviews, other factors considered suitable for the research context were added, then tested to ensure their applicability in this research. This research extends the technology, organisation, environment and individual features of the TOE and DOI frameworks by adding the trust dimensions of the IMOT model and post-adoption review procedure. Previous studies did not point out the importance of trust dimensions when selecting a CSP and they did not consider post-adoption review procedures.

8.2.2 PRACTICAL CONTRIBUTIONS

The practical contributions of this study relate to (1) how the proposed model can be put into effective use and (2) how the findings can help some change agents understand how trust and other factors contribute to cloud computing adoption and perceived usefulness. The result of this study can be used by researchers and educators of innovations, SMEs, CSPs and technology consultants, managers, policy makers and the government.

8.2.2.1 IMPLICATION FOR RESEARCHERS AND EDUCATORS OF NEW TECHNOLOGIES.

For researchers and educators of new technologies/ innovations, the proposed model can be used to study the diffusion of both technological and other innovations within the context of SME. Even beyond the SME context, the variables introduced in the model can be amended to suit any study on innovation acceptance. For example, this research model introduced factors such as knowledge level, benefits, challenges, perceived usefulness and financial readiness. These factors can also be considered by individuals who are considering the adoption of any type innovation.

8.2.2.2 IMPLICATION FOR CLOUD SERVICE PROVIDERS AND TECHNOLOGY CONSULTANTS.

Since the findings of this study disclosed that cloud computing adoption is facilitated by knowledge level, the awareness of cloud computing by CSPs should be increased. CSPs and technology consultants should devise a more proactive means of increasing the awareness of cloud computing especially among those who are not technologically inclined and those in sectors other than IT.

According to Brown and Locket (2004), service providers generally play an important role in the adoption of a technology. In this research context, it is would be worthwhile for the CSPs to learn about the stages of cloud computing adoption and issues affecting its adoption and usage. By understanding that their ability, integrity and benevolence determine their perceived trustworthiness by their clients, which will indirectly influence their reputation, they would strive to increase these attributes. They should focus more on procedures that will improve adoption, learn about the challenges, and understand both individual and organisational characteristics of their clients, then take a more proactive means of promoting cloud computing usage and adoption to SMEs.

Cloud service providers may need to improve their interaction with SMEs' decision makers, remove any vagueness in their SLAs then ensure that all agreements written in their SLAs are well implemented.

Technology consultants will be able to design better strategies for the uptake of cloud services by SMEs if they understand the factors influencing the uptake of cloud services. Since the findings of this researched revealed that cloud computing adoption is facilitated by its knowledge level, the awareness of its benefits (especially among the SMEs) is also very important. Therefore, this study suggests that both CSPs and technology consultants should draw up new procedures (or amend their existing ones) to communicate the benefits of cloud computing services using interpersonal and mass media (workshop, seminars/webinars, online social media etc.).

8.2.2.3 IMPLICATION FOR SMES (MANAGERS AND POLICY MAKERS)

With respect to decision making, a lot of factors come to play. When choices are made, consequences are not usually pre-known. This study can help policy makers within SMEs to make their decision-making process easier. Through the research model, they will be able to increase their awareness of the factors to consider in their decision to adopt cloud computing and new technologies or innovations. In making a choice of a service provider be it in cloud computing adoption or other technologies, these agents will be able to pre-identify the strengths and weaknesses of their potential providers using the CSP selection measures given in the model. Managers must pay great attention to the type of provider they want. They must ensure that the provider is able to provide them with both organisational and technical supports. They also need to assess the risks involved in every decision made (in every step) and they should be able to review their decisions afterwards.

Considering the limitation of this study in terms of the geographical location, the findings cannot be generalised. However, the research model is versatile because any experience gained while using it for a decision about cloud adoption, can be transferred when considering adopting other technologies/innovations. This is because, it considers aspects such as technological, organisational, environmental and individual perspectives. Trust being an important factor in every business, this model also considers that aspect of trust in selecting service providers. The decision to start and continue to use cloud computing should be based on a detailed analysis of the model constructs. As revealed in this study, since SMEs find cloud computing very useful and beneficial, it is recommended that they should use the model in their decisions to adopt cloud services.

8.2.2.4 IMPLICATION FOR THE GOVERNMENT

As gathered from literature and from this research, one major concern for cloud computing adoption is regulatory compliance. Since most cloud infrastructures are hosted in different countries where different privacy and confidentiality regulations apply, issue of regulatory compliance may lead to a loss of privacy and confidentiality of customers' data. Being a part of the challenges of cloud computing adoption, investigated in this research, the result of this study suggests that regulatory compliance influences the adoption of cloud computing. For cloud computing to achieve a higher level of adoption and continued usage, the government may need to review and update its privacy and confidentiality rules especially for SMEs. This is because SMEs play an important role in every country by representing the majority of all business organisations as well as contributing to their GDPs. With this study, the government would be able to understand the concerns of SMEs towards cloud adoption. They will be able to devise a more proactive strategy for supporting them in their courses of adopting and using computing.

CHAPTER 9

CONCLUSION

LIMITATIONS AND FUTURE STUDIES

According to related literature, cloud computing offers many benefits to both organisations and individuals. Some of these benefits are the ease of access to data, flexibility, scalability and pay-per-use option. With the pay-per-use option, cloud users can have access to cloud services on an on-demand basis and only pay for the resources they use. One major organisation that benefits from cloud computing is the SME. This is because the pay-as-you-go option offered by cloud computing allows them to significantly reduce cost and convert the capital expenditure into operational expenditure. On the other hand, cloud service providers through their services, assist SMEs to perform their tasks quicker, easier and more efficiently thus enabling them to improve their business productivities and performances.

In spite of all the benefits of the cloud computing technology, in recent years, it is still believed that SMEs are still lagging behind in terms of migrating from their legacy IT infrastructure to deploying cloud technologies.

The main purpose of this study was to explore the adoption process of cloud computing and understand the role of trust in cloud computing usage and adoption by SMEs. Although this research has fulfilled its objectives, however, there are still many research areas that need additional empirical investigations. Given that a lot of studies have been carried out in the field of cloud computing as well as those involving cloud adoption by SMEs, this study is considered a tiny fraction of work in the entire cloud computing literature. Although, it provides a significant contribution to knowledge with its view of the trust concept.

To achieve the main purpose of this research, a literature review was initially carried out to produce a model, which has been grounded in theories relating to technology/innovation adoption and trust in an organisational setting. To validate this model, the variables making up the model were used to design a questionnaire. This questionnaire was initially sent out (as a pilot study) to 60 SMEs from different business sectors in the UK. The sample was made up of those SMEs who had adopted cloud computing, those planning to adopt, those thinking of adopting and those who had not adopted. These SMEs were randomly selected from an already existing directory of SMEs in the UK. Following the pilot study, the questionnaire was amended with three questions added to it. This change was done to complement the pilot study findings and avoid the selection bias initially introduced in the pilot study. The final survey was sent to 1200 SMEs. The sample frame was stratified using the four parts of the United Kingdom (England, Scotland, Wales and Northern Ireland), with 300 SMEs selected from each part using major databases. These SMEs were from different business sectors.

This following sections provide the summary of the key findings to the research, an overview of each chapters, the limitation of the research and future studies.

9.1 RESEARCH OVERVIEW

This study investigated the issue of trust and other factors that influence the adoption of cloud computing by SMEs. The first chapter of this thesis presented the research context, the research objectives, summary of the originality of the research, practical contributions to knowledge and the thesis structure.

Chapter 2 examined the general concept of cloud computing and the general issues relating to the adoption of cloud computing as well as those pertinent to SMEs. It started with the concept of cloud computing, definition of cloud computing, cloud deployment models, characteristics of cloud computing and the cloud service models. It also discussed the benefits and challenges of cloud computing. Based on this review, the main benefits of cloud computing commonly mentioned by different authors are: reduced cost through pay-per-use option, provisioning of more storage devices, scalability, flexibility, easier access to hardware resources, automated update services and mobility and easier access to data. The main challenges of cloud computing commonly mentioned are security and privacy issues, issue relating to regulatory compliance, confidentiality, data integrity, availability of services, reliability of service providers, malicious insider, contract lock-in and SLA issues. This chapter also reviewed previous studies relating to the adoption of cloud computing by SMEs.

Chapter 3 explored the concept of trust and its operationalization in this research. It discussed trust in online transactions, trust in technology acceptance, previous technological studies highlighting trust issues and a review of trust related models. These models are the Bstieler (2006) trust model of Problem-solving, Communication and Fairness, Cote and Latham (2006) model of Trust and Commitment within an Interorganisational setting and the Mayer, et al. (1995) Integrative Model of Organisational Trust (IMOT). Based on this review, the IMOT was selected for the study and was extensively discussed. It explains trust in an organisational setting by relating it to both the trustor and the trustee. It provided the grounds to which trust was operationalised in this research.

Chapter 4 reviewed different theories/models that explain the acceptance of a technology or innovation. In this regard, six different models/theories were initially reviewed. These are the TRA, TAM, TBP, DOI, UTAUT and the TOE. The variables introduced by the DOI and TOE were combined with those introduced by the IMOT to develop the conceptual model of this research. Compared to other models, the variables introduced by these three selected models relate more to the research context.

Chapter 5 was built on the theoretical models and frameworks discussed in chapter 4. The conceptual model of the research and all its variables were discussed. The hypothesis developed for this study were also presented.

Chapter 6 discussed the overall research design, methods and instrument of data collection. It also discussed the scale of measurement of variables and ethical process used in the research. In Chapter 7, data analysis and results were presented. The analysis was presented in two parts. Part one presented the analysis for testing hypothesis 1 and 2 while part two tested hypothesis 3. Each part of the analysis involved descriptive statistics, reliability testing and factor analysis of all items on a measurement scale. These analysis were followed by an ordinal regression.

Chapter 8 presented the discussion of the research. This chapter reflected on the objectives and hypotheses of the study. It discussed the hypotheses by relating it to the original theories used and the works of other authors in this area of study. It also presented the research contributions to knowledge to both theory and practice. It described the implication of the study to researchers, educators of new technologies, CSPs, IT managers and consultants, SMEs and the government. Chapter 9 presented the conclusion of the study with a reflection on various sections of the thesis.

9.2 A REFLECTION ON THE RESEARCH OBJECTIVES, HYPOTHESES AND RESULTS.

Over the course of this study, the following research objectives have been satisfied.

(1) To identify factors which encourage or inhibit the adoption of cloud computing by SMEs.

As demonstrated in chapter two, the factors which encourage or inhibit the adoption of cloud computing by SMEs were identified. From all participants' responses to the survey, the top ranking factors that encourage the adoption of cloud computing are Flexibility (58%), Reduced Cost (56%), Provisioning of Mobility and Easier Access to Data (56%), Automated Update

Services (53%), Scalability (52%), Reduced Technical Complexities (49%), Provisioning of More Storage Spaces (48%) and Easier Access to Hardware Resources (46%). In the same manner, those factors that inhibit cloud computing adoption are in the order of: CPS's Contact Lock-in (54%), Lack of Data Integrity (50%), Malicious Insider (49%), Regulatory Compliance (49%), Cost and Difficulty of Migration (48%), Lack of Confidentiality of Data (46%), Service Level Agreement Issues (46%), Loss of Control of Service (44), Lack of Privacy (44%), Lack of Liability of Providers in Case of Security Incidence (42%) and Lack of Availability of Data (42%).

(2) ***To investigate whether any of the factors mentioned above has any influence on the adoption or perceived usefulness of cloud computing.***

This study investigated the influence of the inhibiting factors on the adoption cloud computing. Conclusions drawn was that the higher the awareness of cloud computing challenges, the lower its chances of adoption. The study further investigated whether the probability of perceiving cloud computing as useful increases when trust in CSPs increases (Hypothesis 3). This hypothesis produced a counter-intuitive result. Further investigation on the result showed that majority of the participants mentioned that cloud computing is useful but indicated a complete disagreement to trust on their CSPs. Hence, one reason for the negative association between trust and perceived usefulness of cloud computing. Another reason was due to the negative correlation that exists between trust and perceived usefulness. The conclusion drawn here was that a positive adoption decision could be influence by either trust or perceived usefulness and as such, they are seen as substitutes.

(3) ***To research into the role of trust in cloud computing adoption.***
(4) ***To develop and validate a conceptual model which can be used to study SME's adoption of cloud computing services.***

This study also researched into the concept of trust and its role in relation to cloud computing adoption. Trust was explained and operationalized using the IMOT model and its variables (objectives 3). In line with the DOI and TOE, which explain the adoption process of a new technology/innovation, the IMOT variables were added to develop the conceptual model proposed in this study (objective 4). This model integrated trust and other factors (adapted from the IMOT, DOI and TOE) to better explain the adoption process of cloud computing by SMEs.

The model was validated using an online survey of 269 SMEs in the UK (check chapter 6 and 7 for full details).

(5) To discuss how the model can be practically used (by SMEs, Cloud Service Providers and the research community) to study the stages of cloud adoption and how it can be applied to other new technologies or innovations.

The model developed in this research can be put into effective use by researchers, educators of new technologies/innovations, CSPs, IT managers and consultants, SMEs and the government. It can also be used to study the adoption of other technologies/innovations in studies done in the UK and outside the UK (see chapter 8 for full details regarding the use of the model) (objectives 5).

9.3 LIMITATIONS AND FUTURE STUDIES

As explained previously, there hasn't been a lot of research about trust in the cloud computing context in relation to SMEs, or those that specifically explored the concept of trust between the CSPs and their clients (SMEs). This means that with this study, newer areas of research have emerged.

Although this research has demonstrated its main contributions to knowledge, and taking a quantitative approach also proved beneficial. However, the findings of this study cannot be generalised. This study is limited to using SMEs in the United Kingdom as its main focus. Being that Tyler and Hurley (2011) reported that UK SMEs appeared to lag behind the rest of Europe in terms of cloud adoption, similar research can be done to collect data from a larger sample. Such research can use mixed method to collect data from both SMEs and CSPs for a more comparable result.

This study makes the observation that despite the fact that cloud computing services provide lots of benefits to SMEs, SMEs in sectors other than ICT and Accounting and Finance have not taken full advantage of it. For example, this research showed that out of 102 adopters from 14 business sectors, majority of them were from ICT (30%) and Accounting and Finance (19%) (See Chapter 6, Table 5). Further investigation on knowledge level of cloud computing by business sector also showed that majority of the respondents (from adopter companies) who were experts in cloud computing were from ICT (30%) and Accounting and Finance (17%). This means that cloud computing is not much known to people in other business sectors when compared to ICT and Accounting and Finance. A similar study can be carried out to focus on a particular sector of the SME or compare the different factors influencing the adoption of cloud computing in two or more business sectors. This is because, these factors could also be sector-specific.

In terms of the design of the study, the method adopted was limited to quantitative method (online survey), which is regarded as the best method of reaching a wider populace and covering a wider topic area. Due to a number of constrains in combining methods for this research (e.g time and cost), large-scale research is encouraged where different methods can be mixed or tried separately. For example, those that will initially explore the subject area by interviewing different stakeholders, managers, CSPs and directors, then subsequently collect a quantitative data from a larger sample and compare their results.

Since the factors influencing the adoption of cloud computing and other related technologies may change over time, it would be interesting to consider a research on a firm's performance before and after adoption.

In terms of making a proper choice for a CSP, further study is encouraged to evaluate and review the services of different CSPs in different countries. This can be done by comparing their offerings, pre-evaluate the risk of choosing each of them, then provide a guideline on how to sign on to their services. This will enable SMEs with a potential interest in cloud adoption to find a better means of selecting a service provider.

Failure to confirm hypothesis 3 implies that cloud computing adoption could either be influenced by its perceived usefulness or the trust of CSPs. However, further research is suggested to investigate the influence of trust on the adoption of cloud computing. This can be done using only the adopters of cloud computing.

Finally, similar study can be done by sampling SMEs worldwide or in a particular continent. This is because, the findings from this studies cannot be generalised to SMEs worldwide.

In spite of the limitations of this study, the DOI, TOE and IMOT variables have proven to be to be valid and applicable in studying the adoption of cloud computing by SMEs. The research model could be used by other researchers in the field. It could provide a strong theoretical foundation for studies relating to general innovation adoption.

Conclusions drawn in this research are (a) the higher awareness of cloud computing challenges, the lower the chances of adopting cloud computing, (b) an increase in the knowledge level of cloud computing will increase adoption and (c) despite reporting by the majority of the respondent that cloud computing is very useful, trusting their CSPs was found to be a major concern.

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APPENDICES

THE PILOT AND FINAL QUESTIONNAIRE

APPENDIX I: PARTICIPANT INFORMATION SHEET

Section A: The Research Project

1. Title of project

Investigating Trust Issues between Cloud Service Providers (CSPs) and Clients of Cloud Services in the UK.

2. Purpose and value of study

- To identify the factors that encourage or inhibit the adoption of cloud computing by SMEs.
- To research into the role of trust in cloud computing adoption.
- To develop a model that can be used to understand the adoption of cloud computing by SMEs.
- To discuss how the model can be used by SMEs, researchers, cloud service provider, managers, policy makers and government and how it can be applied to other innovations.

The value of this research is that the recommended model will assist SMEs to assess the factors involved in cloud adoption then make a decision. They would be able to make proper choice of a service provider using the dimensions of trust given in the model.in their service providers, increase cloud adoption and business productivity. Also, the developed trust model will be helpful in teaching the factors involved in innovation acceptance. It will also help clients understand the role of trust in technology acceptance as well as factors that influence technology acceptance.

3. Invitation to participate

As a client or potential client of cloud service, you are invited to take part in this questionnaire survey in order help the researcher

- Identify the factors that influence cloud computing adoption by SMEs.
- Determine the role of trust in cloud computing adoption by SMEs.
- Determine the extent at which trust issues between CSPs and their clients (SMEs) hinder the usage and adoption of cloud computing by SMEs.

- Recommend possible solution that will increase trust in CSPs as well as the adoption of cloud services by SMEs.

Through the administration of an online questionnaire, I intend to carry out this research for the purposes highlighted in item 2 above.

4. Who is organising the research?

Vivian Oyemike is completing this research as part of an award of a PhD in Computing and Technology, Faculty of Science and Technology, Anglia Ruskin University.

5. What will happen with the results of the study?

The responses collected will be used to determine the extent to which trust can be perceived as key to improving the use of cloud services by Small and Medium Business. The results will be compared with that of the past research survey, a model indicating the role of trust in cloud adoption will be proposed, and will be made available in my final thesis.

6. Source of funding for the research

There is no external bodies funding this research.

7. Contact for further information

Researcher's name and email: Vivian Oyemike (vivian.oyemike@student.anglia.ac.uk).

Supervisor's name and email: Antony Carter (Antony.Carter@anglia.ac.uk)

Section B: Your Participation in the Research Project

1. Why you have been invited to take part?

You have been invited to take part because you were randomly selected from a publicly available database of SMEs.

2. Whether you can refuse to take part

There is no compulsion to take part. Participation is entirely voluntary.

3. Whether you can withdraw at any time, and how

You are free to withdraw at any time up to the point the submit button is pressed in the online questionnaire. It will not be possible to remove your responses from the survey once your responses have been submitted.

4. What will happen if you agree to take part (brief description of procedures/tests)?

You will fill in an online questionnaire survey. Once you press the submit button, it means you have consented.

5. Whether there are any risks involved (e.g. side effects from taking part) and if so what will be done to ensure your wellbeing/safety

There are no risks involved because you will only be required to participate in an online survey and questions will be in a non-sensitive nature.

6. Agreement to participate in this research should not compromise your legal rights should something go wrong

These right arrangements do not affect your ability to pursue a claim through legal action.

7. Whether there are any special precautions you must take before, during or after taking part in the study

No special precautions required.

8. What will happen to any information/data/samples that are collected from you?

The information will be saved on a password protected personal computer and will only be analysed in order to investigate how trust issues between clients and their CSPs affect the adoption of cloud service and business productivity.

9. How long it will take you to complete the survey?

To complete the survey, you will need approximately 15 minutes.

10. Whether there are any benefits from taking part

As a result of the significant role that SMEs play in the economy, any strategy/technology that will make them become more innovative and competitive will also improve the economy. By identifying the factors impacting on SMEs' decision to adopt cloud computing in a model and validating that model, the CSPs will be able to design their system putting those factors into consideration. You will be contributing to the validation of the model by answering the questionnaire. The questionnaire also contains items that will help the researcher investigate trust issues (between CSPs and SMEs) as well as the role of trust in cloud computing adoption; which may also increase the uptake of cloud services by SMEs in the UK. You will also contribute to recommend possible solutions that will increase trust between CSPs and their clients.

11. How your participation in the project will be kept confidential?

All your answer to the questionnaire will be analysed anonymously. And no personal information will be obtained from you.

DEFINITITION OF CLOUD COMPUTING IN THIS RESEARCH

In this research, cloud computing is defined as an on-demand, pay-per-use, convenient access to a pool of scalable service and virtualised computer resources distributed globally and independently through an internet connection. Cloud computing in this regard refers to a business-based model cloud system e.g. server, storage and applications that are delivered to an organisation through an internet connection. These are shrouded into Software-as-a-Service (SaaS), Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (Dihal, et al., 2013).

APPENDIX II: PILOT QUESTIONNAIRE

1. Before providing a response to the survey please confirm you are 18 or over?

a. Yes

b. No

2. What is your primary role in your organisation?

   a. Chief Information Officer

   b. IT manager

   c. Network administrator

   d. IT director

   e. Company Director

   f. Business Owner

   g. Others (please specify) [ ]

3. Approximately, how many people are employed by your organisation?

   a. 1-9 Employees

   b. 10 – 49 Employees

   c. 50 – 249 Employees

   d. 250+ Employees

   e. I don’t know

4. Which of the following business sectors does your organisation operate in?

   a. Accounting and Finance

   b. Manufacturing

   c. Information Communication Technology

   d. Retail

e. Transport

f. Construction

g. Health and Social Care

h. Insurance

i. Hotel, Travel and Leisure

j. Real Estate

k. Music, Art and Entertainment

l. Food and Drink

m. Education

n. Others (please specify) [ ]

5. From the options below, which describes your knowledge about cloud computing?

a. I have no knowledge of cloud computing

b. I have little knowledge of cloud computing

c. I have some knowledge of cloud computing

d. I have good fundamental knowledge of cloud computing

e. I am an expert in cloud computing

Question 6 and 7: this page consists of question about your company's level of awareness of cloud computing benefits and usage.

6. How beneficial do you think cloud computing would be/is to your business?

a. I don’t know

b. Not beneficial

c. Less beneficial

d. Beneficial

e. Very beneficial

7. Is your company currently using or intending to use cloud computing?

a. I don't know.

b. My company neither uses nor plans to use cloud computing services.

c. My company is thinking of using cloud service in the future.

d. My company is planning to use cloud service.

e. My company is using cloud service.

INSTRUCTION:

I. If your company is already using, planning to using or thinking of using cloud computing, can you

- **Identify the type of cloud service you use or intend to use 8?**
- **Identify why you are using or intending to use cloud computing in question 9?**
- **Identify the issues faced despite your continued adoption in question 10?**

II. If your company neither uses or plans to use cloud computing, can you respond to question 10 if they are part of the issues affecting your adoption decision or end the survey if not?

8. What type of cloud service is your company using or intending to use?

a. I don't know

b. Software-As-A-Service (SaaS)

c. Platform-As-A-Service (PaaS)

d. Infrastructure-As-A-Service (IaaS)

9. The following have been identified as the principal reasons behind clients' decision to adopt cloud computing in their organisations? Please define the extent to which you agree or disagree with the following.

Reasons	I don't know	Neither Agree nor Disagree	Strongly Disagree	Disagree	Agree	Strongly Agree
Reduced cost						
Easier access to hardware resources						
Scalability						
Provisioning of more storage spaces						
Reduced technical complexities						
Automated update services						
Provision of mobility of, and easier access to, data						

Flexibility						

10. The following have been identified as possible issues with cloud service adoption. To what extent do you agree or disagree that they affect your decision to adopt cloud computing or are still concerns despite adoption?

Concerns	I don't know	Neither Agree nor Disagree	Strongly Disagree	Disagree	Agree	Strongly Agree
Regulatory Compliance						
Cost and Difficulty of Migration						
Inconsistency between transnational laws and regulations						
Lack of Privacy						
Lack of Availability of Service and/data						
Lack of Confidentiality of Data						

Lack of Data Integrity						
Lack of liability of providers in case of security incidence						
Loss of Control of Service						
Malicious Insider within the CSP's Organisation						
Service Level Agreement (SLA) Issues						
CSP's Contract Lock-in						

QUESTION 11 consists of questions on factors to consider when deciding to adopt cloud computing

11. Are / were the following factors considered in your decision process of cloud computing adoption? Please indicate the extent to which you agree or disagree.

Factors	I don't know	Neither Agree nor Disagree	Strongly Disagree	Disagree	Agree	Strongly Agree
Compatibility with our existing practices/technology						
Cloud computing is complex to use						
Trying cloud computing before decision was very important to us						
The on-going cloud security concerns were taken into consideration before we made our decision.						

QUESTIONS 12 – 15 consist of questions about the features of your company, its environment, its employees and the criteria for choosing your current cloud service provider.

NOTE: Cloud Services Provider (CSP) is a vendor or company responsible for providing cloud technology to cloud service users (with the exception of Social Media).

12. The following have been identified as criteria for choosing a cloud service provider. How important are/were they for you in considering a cloud service provider?

Features	I don't know	Neither Important nor Unimportant	Extremely Unimportant	Unimportant	Important	Extremely Important
Cost of service						
CSP's ability to offer a consistent service						
Clear SLA						
Data security methods available						
Professionalism						
Reliability						

Reputation						
Existing client base/work history						
The location of my data						
Migrating between CSPs						

13. Organisational features: The following statements aim to capture the features surrounding your company. How well do they describe your company?

Features	I don't know	Neither Agree nor Disagree	Strongly Disagree	Disagree	Agree	Strongly Agree
Our company receives and processes large quantities of data						

My company depends on real-time information						
Available financial resources and IT usage within our company are/were considered in our adoption decision						
The size and location of our company influences our adoption decision						

14. Environmental features: The following statements relate to the environmental features surrounding your company. Please indicate the extent to which you agree or disagree to them.

Features	I don't know	Neither Agree nor Disagree	Strongly Disagree	Disagree	Agree	Strongly Agree
It is very important for our company to receive extensive technical support from our CSP						
Receiving exceptional customer service from our CSP matters a lot to us						
It is very important for our company to receive extensive cloud computing training from our CSP.						
We use current IT services to gain competitive advantage over our rival companies						

We tend to devise new ways of gaining competitive advantage in our business						

15. Individual features: How well do the following statements describe your employees' Information Systems (Cloud Specific) Knowledge and Innovativeness?

Features	I don’t know	Neither Agree nor Disagree	Strongly Disagree	Disagree	Agree	Strongly Agree
Employees in the IT department have basic knowledge of cloud computing						
I have basic knowledge of information technology.						
I know the difference between cloud computing and						

traditional computing.						
I like to come up with new ways of doing things						
I often take risks to see things done differently						
I prefer creating something new than improving on something existing						

NOTE: Questions 16 - 18 consist of questions about your cloud computing experience in your company and how you would rate your current CSP

16. My experience of using cloud computing in my current company is ………

a. Very Poor
b. Poor
c. Fair
d. Good
e. Very Good
f. Excellent

17. Please indicate how you would rate your CSP on the following measures.

Statements	I don't know	Neither Agree nor Disagree	Strongly Disagree	Disagree	Agree	Strongly Agree
INTEGRITY						
My CSP will always stick/conform to their SLA.						
My CSP behaves in a consistent manner.						
My CSP's attitude to service delivery seems to be governed by sound principles.						
My CSP seems to have a good sense of fairness.						
ABILITY						

My CSP is very capable in their service delivery						
My CSP is known to be a successful provider						
I feel confident about the skills of my CSP						
My CSP has specialized capabilities that can increase our performance						
My CSP appears to be very knowledgeable about the work they do						
BENEVOLENCE						
My CSP is very concerned about our cloud computing						

needs and requirements						
My CSP really looks out for, and informs us of, services that are important to us.						
My CSP will go out of their way in wanting to satisfy our needs and expectations by offering exceptional customer services						
My CSP would not knowingly do anything that can harm our business relationship						
REPUTATION /RISK						

We initially chose our CSP because of their good reputation						
There was absolutely no risk in choosing my CSP.						
Our choice of a CSP was based on extensive research of highly respected sources.						

18. How would you rate your current trust level in your CSP?

a. Not Sure
b. Very Low
c. Low
d. Fair
e. High
f. Very High

FEEDBACK PAGE: This is a pilot study. Please I will appreciate your feedback below regarding the nature of the questions to enable me make necessary adjustment in the actual survey. Thank you

APPENDIX III: THE FINAL QUESTIONNAIRE.

Following the feedback given in the pilot study, three more questions were added to the initial 18 questions. These make up the final questionnaire. Two of the questions were specifically designed for those participants whose companies have already adopted cloud computing (added as questions 19 and 21). These include their number of years of using cloud computing and their overall ratings of their trust level on their CSPs. This was to check whether the trust they have on their CSPs increased or decrease using with time. The third question was directed to those participants whose companies are neither using nor plan to use cloud computing (added as question 10). This aimed at assessing the main factor hindering their decision to cloud adoption. These three questions are as follows:

1. Please identify which of the following reasons is affecting your decision to adopt cloud computing
   a. Trust issues
   b. Lack of financial availability
   c. Our company is still small
   d. The location of our company doesn't require cloud adoption
   e. Lack of compatibility with our existing infrastructure
   f. Other please specify

2. How long have you been using cloud computing in your company?
   a. Less than one 1 year
   b. 1 to 3 years
   c. 4 to 6 years
   d. 7 to 10 years
   e. More than 10 years.

3. How would you rate your current trust level in your CSP?
   a. Not sure

b. Low

c. Moderate

d. High

Conclusion: Thank you for your participation in this survey. Please click next to end the survey.

APPENDIX IV: DIFFERENT DEFINITIONS OF CLOUD COMPUTING

AUTHOR	DEFINITION
IASA, 2009	The term cloud computing relates to both applications that deliver services over the web also to the hardware and system software that provides these services. The application services are considered software as a service; the hardware and system software is what we define as the cloud. Cloud computing is characterized by two significant characteristics; experience unlimited resources and pay per use. The service that is offered by the cloud is known as utility computing and it is closely related to electricity and water resource usage. When a cloud is available to the public, it is called a public cloud. A private cloud is that which is not made available to the public. A cloud that cannot offer unlimited supply and pay per use is not cloud computing. In other words, cloud computing includes both utility computing as well as software as a service.
NIST, 2009	Defines cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".
P. Gaw, 2008	Using the internet to allow people to access technology-enabled services.
J.Kaplan, 2008	A broad array of web-based services aimed at allowing users to obtain a wide range of functional capabilities on a 'pay-as-you-go' basis that previously required tremendous hardware or software investments and professional skills to acquire. Cloud computing is the realization of the earlier ideas of utility computing without the technical complexities or complicated deployment worries…
R. Bragg, 2008	The key concept behind the cloud is web application - a more developed and reliable cloud. Many find it now cheaper to migrate to the web cloud than to invest in their own server farm. It is a desktop for people without a computer.
Gartner, 2008	A style of computing where scalable and elastic IT-enabled capabilities are delivered as-a-service to external customers using internet technologies.

Cloud Computing Definitions (Vaquero, et. al., 2008)