UNIVERSITY OF SOUTHAMPTON

FACULTY OF PHYSICAL SCIENCES AND ENGINEERING
Department of Electronics and Computer Science

A model of a Private Sector Organisation's Intention to Adopt Cloud Computing in the Kingdom of Saudi Arabia

By
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Abstract

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Cloud computing is a paradigm for providing and delivering IT services over the Internet. The cloud can provide several benefits for organisations, including cost reduction and flexibility. In developing countries, such as Saudi Arabia, cloud computing is still not widely adopted. In fact, migrating an existing system to the cloud depends on a number of factors that may affect an organisation's decision to adopt the cloud in the private sector in Saudi Arabia. In order to encourage the adoption of cloud computing, it is important to understand why some organisations are willing to move to the cloud while others are not. Therefore, the aim of this research is to investigate the factors that may influence an organisation's decision regarding adopting cloud computing. An integrated model is proposed which incorporates critical factors derived from a literature review on technology adoption and cloud computing along with other factors (such as physical location) that have not been examined in previous studies as main factors that may affect the organisation's decision to adopt cloud services.

A study was conducted in private sector organisations in Saudi Arabia in order to improve the proposed model. Interviews were carried out with IT experts to review the identified factors and explore other factors that were not mentioned in previous studies. The second stage of this study was an online questionnaire which was used to confirm the existing factors in the cloud adoption model and other factors that were identified from interviews (trialability, external support, industry, and culture). Among the 17 factors examined, the

results of the questionnaire revealed that only two, complexity and competitive pressure, did not significantly impact the adoption decision.

Finally, a questionnaire was conducted with 300 IT staff in different organisations in the private sector in Saudi Arabia, in order to test the model for cloud adoption and to explore factors that were positively or negatively associated with cloud adoption. The findings of the evaluation study showed that there was both a direct and indirect effect of the factors on an organisation's intention to adopt the cloud. The findings of this study showed that quality of service and trust are the most influential determinants of cloud adoption. However, security and privacy concerns still prevent cloud adoption in this country. Furthermore, the physical location had a significant direct effect on compliance with regulation and privacy. This study also showed that the effect of these variables differed according to organisation size and in adopter and non-adopter companies. The results confirmed that the proposed model was well-fitted with the collected data. Thus, the developed model is valuable in explaining the adoption of the cloud at organisational level. Overall, the findings of this research provide great value in terms of guidelines to the organisations, cloud providers, managers, government and policy makers on ways of increasing the implementation and encouraging the spread of cloud computing in Middle Eastern countries particularly in Saudi Arabia.

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Declaration of Authorship

I, Nouf Rashed Al khater.

declare that this thesis and the work presented in it are my own and have been generated by me as the result of my own original research.

A model of a Private Sector Organisation's Intention to Adopt Cloud Computing in the Kingdom of Saudi Arabia

I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University;
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- Where I have consulted the published work of others, this is always clearly attributed;
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
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Signed:
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Abbreviations

AMOS	Analysis of Moment Structures
AVE	Average Variance Extracted
CFI	Comparative Fit index
CSP	Cloud Services Provider
DOI	Diffusion of Innovations Theory
EC2	Elastic Compute Cloud
ERP	Enterprise Resource Planning
GCC	Gulf Cooperation Council
GoF	Goodness of Fit
IaaS	Infrastructure-as-a-Service
ICT	Information and Communication Technology
ML	Maximum Likelihood
PaaS	Platform-as-a-Service
RMR	Root Mean Square Residual
RMSEA	Root Mean Square Error of Approximation
SaaS	Software-as-a-Service
SEM	Structural Equation Modelling
SLA	Service-Level Agreement
SME	Small and Medium Size Enterprises
SPSS	Statistical Package for the Social Sciences
SRMR	Standardised Root Mean Square Residual
TAM	Technology Acceptance Model
TLI	Tucker-Lewis Index
TOE	Technology Organisation Environment Framework

Chapter 1: Introduction

Cloud computing is a term used to describe distributed computing connected over a network to provide utility services to the end user (Buyya et al., 2009). The cloud allows users to access services anytime and anywhere, and to only pay for what they use. Cloud computing was a dream in the sixties (Chen et al., 2010), when John McCarthy predicted the power of computing to provide utility services like water and gas. In order to achieve this goal, a number of paradigms have been developed (e.g., grid computing), but none has succeeded in offering a public service the way cloud computing has.

Most enterprises around the world spend from 1 to 5 % of their revenue on IT infrastructure and tend to spend greater sums of money on resources than they actually require (Hofmann, 2008). In Saudi Arabia, more than half of large organisations plan to increase their budgets for Information and Communication Technology (ICT) (Communications and Information Technology Commission, 2015). For instance, in 2015, the Saudi government spent 31 billion US$ on ICT services, and this sum is expected to increase in future years (Ministry of Communications and Information Technology, 2016). Saudi Arabia is considered as the largest ICT spender in the Gulf Cooperation Council (GCC) countries (Communications and Information Technology Commission, 2015). However, cloud computing offers several benefits for enterprises. The cloud frees organisations from having to set up an IT infrastructure and allows them to rent resources and pay only for the services they use (Buyya et al. 2009). This can reduce costs and save a lot of money for both small and large enterprises. Thus, cloud offers opportunities for organisations to reduce capital expenditure and focus on their core business (Armbrust et al., 2010). In addition, cloud computing increases flexibility and offers an attractive opportunity for enterprises to grow (Marston et al., 2011).

Despite all these benefits, some enterprises nevertheless hesitate to move their present system to the cloud. Furthermore, the adoption of cloud computing technology is still in its early stages in Saudi Arabia, unlike developed countries. There are several factors that may affect an organisation's decision to migrate to the cloud. Thus, this research aims to investigate these influential factors in depth among private sector organisations in Saudi Arabia and to understand why organisations are willing or unwilling to move to the cloud.

This research proposes an integrated model in an attempt to find out what might encourage an organisation to adopt cloud services or might impede them from adopting it in the private sector in Saudi Arabia.

1.1 Overview of Saudi Arabia

This section provides an overview of Saudi Arabia, which is the home of largest petroleum companies in the Middle East. Saudi Arabia is located on the continent of Asia with a population over 30 million. The main revenue source for the economy of Saudi Arabia is petroleum and it is considered to be one of the largest oil producers and exporters in the world. In addition, there are other natural resources in Saudi Arabia, including natural gas, iron ore, gold, and copper. The percentage of private sector organisations in Saudi Arabia represents 99.7% of the total number of organisations and only 0.3 % are in the government sector (public sector) and about 40% of total GDP represented by private sector (General Organization for Social Insurance, 2016). Table1-1 shows the percentage of organisations in the private and public sectors. Recently, after plunging oil prices, the Saudi government set new plans to enhance economy instead of depending on oil as its main source of its income. In the budget for 2016, the Saudi Arabia government announced that would reduce government subsidies by privatising a range of sectors and economic activities (Ministry of Finance, 2015).

At the organisational level, ICT has played an important role in transforming most operational practices and organisational tasks, as well as enabling electronic services to be provided in both private and public sectors (Beynon-Davies, 2005). Moreover, ICT now plays an essential role in the economies of many countries and its use is increasing rapidly worldwide (Ndou, 2004). Saudi Arabia is the largest markets for ICT in the Middle East. However, although the Saudi government supports the development of ICT across the country and has set a plan for the next twenty years, ICT in Saudi Arabia is still at the developmental stage. According to Al-Nuaim (2011) and Alghamdi et al. (2014), the implementation of e-government in Saudi is impeded by the weakness of ICT infrastructure. In addition, every country has a different environment and conditions. Therefore, for each country different aspects should be taken into consideration when deciding to adopt new technology.

There are several factors that have affected the culture of Saudi society, including religion and the tribal system. Saudi Arabia is the heart of Islam and homeland of two of its holy mosques, Al-Masjid al-Haram and Al-Masjid an-Nabawi. The Saudi society is religious by nature and Islam has a significant influence on its culture, which means the religion has an impact in defining obligations, traditions and social behaviour. The other aspect that affects culture and influences the people in Saudi Arabia is the tribal system. Tribalism is defined as type of behaviour which is based on shared values and habits between the tribal members. Tribal traditions and kinship are still evident in Saudi society and still have an impact on an individual's place in society as well as on their success or failure (Al-Shehry et al., 2006). However, the Saudi Arabian government is seeking to modernise all aspects of life in society and move towards to becoming a developed country in the future.

Table 1- 1 Percentage of public and private sector organisations in Saudi Arabia (General Organization for Social Insurance, 2016).

Sector	**Percentage**
Government	0.3%
Private	99.7%

Table 1- 2 Percentage of private sector organisations by ownership (General Organization for Social Insurance, 2016).

Sector	**Percentage**
Saudi companies	99.2%
Non- Saudi companies	0.8%

1.2 Research Aim and Objectives

As mentioned above, the adoption of cloud computing in developing countries, including Saudi Arabia, is still in its early stages and cloud computing has not been as widely adopted as in developed countries. In fact, moving a traditional system to the cloud depends on many factors that may impact on an organisation's decision to employ cloud services. Therefore, the aim of this research is to carry out an in-depth investigation of the factors that influence

an organisation's intention to adopt cloud technology in the private sector in Saudi Arabia and to understand why some enterprises are more prepared than others to move to the cloud. To address the above aim, the objectives of this study are presented as follows:

- To identify the factors that might influence an organisation's decision to adopt cloud technology.

- To develop a conceptual model that can be utilised to examine the adoption of cloud computing in organisations.

- To explore factors that encourage or impede cloud adoption in the private sector in Saudi Arabia by evaluating the conceptual model quantitatively.

- To fill the gap in the existing literature and provide guidelines for organisations, technology providers, managers, government and policy makers who are interested in increasing the adoption and spreading of new technologies like cloud computing in a developing country such as Saudi Arabia.

1.3 Research Questions

This research seeks to answer the following research questions:

Q1. What are the influential factors in an organisation's decision to adopt cloud computing technology in the private sector in Saudi Arabia?

Q2. What is the relationship between the factors and an organisation's intention to adopt cloud services?

Q3. Does the size of an organisation moderate the relationships between the factors and an organisation's intention to adopt cloud services?

Q4. What is the difference between adopter and non-adopter companies in terms of the effect of these factors?

1.4 Thesis Structure

Figure 1-1, provides a summary of the methodology used in this research. The remainder of this thesis is structured as follows:

- Chapter 2: This is the literature review section, which begins with the background of cloud computing, to understand its basic concepts and essential characteristics. The chapter reviews the existing work and theories in order to identify factors that affect an organisation's decision to adopt cloud computing. Finally, this chapter identifies the research gaps.

- Chapter 3: Presents the proposed model for cloud computing adoption and identifies the factors that may influence an organisation's decision to adopt cloud computing technologies.

- Chapter 4: Offers an overview of the research method of the exploratory study. It begins with a brief description of the qualitative and quantitative methods and different tools utilised in this study; it then discusses the research methods used in the study. Finally, the chapter discusses the calculation of the sample size and the ways in which the questions were designed.

- Chapter 5: Presents the findings of the mixed methods utilised in this study. The first part presents the findings of the interviews and the second part presents the results of the online questionnaire in this study. This chapter also provides an in-depth discussion of these findings.

- Chapter 6: Presents the research methods used in the second stage of this research to evaluate the proposed model and test the research hypothesis. It begins with a brief discussion of the research philosophy and approach that fit this research. It discusses the research strategy used in the second stage of this research and the ways of designing and developing the questionnaire. This chapter also explains the sample size which was considered appropriate for this study and the tests utilised for

verifying reliability and validity of the instrument. Finally, it explains the procedures used for data analysis.

- Chapter 7: Presents the findings of the evaluation study. It provides the results of the questionnaire conducted with IT staff in the private sector in Saudi Arabia. The chapter begins with results of the preliminary analysis of the data, which involves addressing some missing data and demographic and institutional information. The reliability of the instrument is also discussed in detail. The chapter then presents the results of assessing the proposed model through Structural Equation Modelling (SEM) in two stages (measurement model assessment and structural model assessment). Finally, Chapter 7 provides a summary of the assessment of the research hypotheses.

- Chapter 8: Provides an in-depth discussion of the findings of the evaluation study. It discusses in detail the impact of technological factors, organisational, environmental and social factors on an organisation's intention to adopt cloud technology in SME and large companies, along with the potential reasons for each finding. It also provides a discussion of the differences found between the organisations that were already using the cloud services and non-adopters. The chapter ends with a summary of the research questions that have been answered in this research.

- Chapter 9: This is the final chapter, which provides an overview of the research. It points out and discusses the theoretical and practical contributions of this study. It suggests the directions for future work.

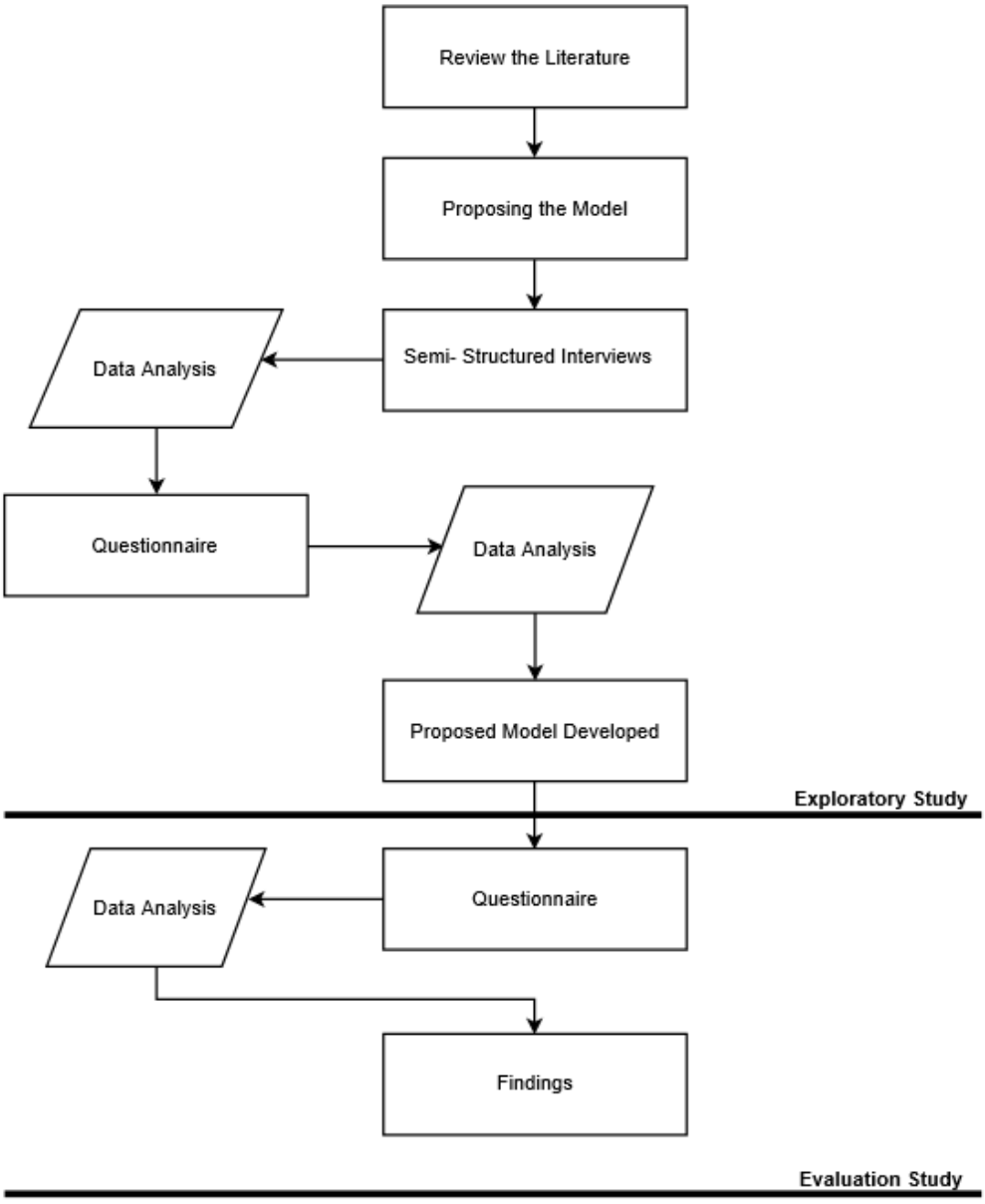

Figure 1-1 An overview of the research methodology.

Chapter 2: Literature Review

This chapter provides an overview of cloud computing and the activities in the field. The essential features and characteristics of a cloud are presented and the architecture of a cloud is discussed. The chapter also examines the existing research and approaches regarding the migration to cloud computing. The most common theories used to measure acceptance of technologies are discussed beside reviewing other proposed models to investigate factors that affect an organisation's decision to adopt cloud computing.

2.1 Research Philosophy

The research philosophy or paradigm is defined as "*a set of shared assumptions or ways of thinking about some aspect of the world*" (Oates, 2005). Research philosophy is based on assumptions. The philosophical assumptions of the research can support and assist the researcher in determining both the research strategy and the methods (May and Williams, 2002; Collis and Hussey, 2009). Guba (1990), classifies such assumptions into three paradigms: ontology (reality), epistemology (knowledge) and methodology. Ontology refers to the nature of the reality or world, while epistemology is about the validity of knowledge and belief, and methodology means the use of systematic methods to resolve the research problem (Kothari, 2004; Merriam, 2009; Creswell, 2013). According to Saunders et al. (2009) there are four types of philosophical assumptions: positivism, interpretivism, realism and pragmatism. The positivism and interpretivism philosophies are based on different philosophical assumptions but they are widely adopted and utilised by the majority of scientists (Remenyi, 1998).

Positivism is an epistemological position. This philosophy adopts the methods of natural sciences (Saunders et al., 2009). In a positivist approach the researcher is seen "*as objective analyst and interpreter of a tangible social reality"* (Remenyi, 1998). The process of gaining knowledge is not affected by the researcher, which reduces bias. So, the researcher is independent and does not consider him or herself an important factor in the research (Remenyi et al., 1998). Positivist researchers consider this approach is suitable for hypothesis testing: discovering a phenomenon and making a prediction (Cassell and Symon, 1994; Collis and Hussey, 2003). In this approach the researchers always seek to explain the

social phenomena via causes and effects and test their research hypotheses statistically, with an adequate sample size, which is usually large (Henn et al., 2006).

In an interpretivist philosophy, the researchers are considered as part of the social world and believe that reality is constructed through social interaction (Merriam, 2009; Matthews and Ross, 2010). The interpretivist researchers believe that the social phenomenon emerges through the interaction of individuals. These researchers conduct their research *"within a phenomenological framework"* (Lancy, 1993) and thus develop a subjective interpretation of the social reality (Creswell, 2012). This approach offers an opportunity to understand social reality from the point of view of the researcher (Robson, 2002). Through this approach, it is difficult to control the end-point of study and it also needs more recourse to data collection (Amaratunga et al., 2002). Thus, the research tends to be unstructured (Henn et al., 2006). The subjective nature and potential bias are the disadvantages of this interpretive approach (Marriam, 2009).

Realism is a philosophy that relates to scientific research. According to Saunders et al. (2009) "*The essence of realism is that what the senses show us as reality is the truth: that objects have an existence independent of the human mind"*. This approach is very similar to positivism in using a scientific methods for knowledge development. The pragmatist philosophy is an appropriate paradigm when a specific philosophy is suitable to answer one research question, while another research question could be answered through a different philosophy (Saunders et al., 2009). Thus, the pragmatist philosophy is an integration of the two philosophies.

This research adopts a positivist position, as this research use scientific methods. The positivist approach is in line with the research objectives. The aim of this research is to investigate the factors that may influence an organisation's decision to adopt cloud computing in the private sector in Saudi Arabia. Therefore, this research focuses on assessing relationships among variables and their effects on adoption cloud. In addition, the research hypotheses that have been constructed need to be tested statistically. Consequently, all this fits with the positivist paradigm. According to Collis and Hussey (2009), reviewing existing theories in literature to develop a theoretical framework and also constructing hypotheses and testing them, are all methods associated with a positivist paradigm. On the whole, the methods utilised in this study are well-suited with this philosophy. Furthermore,

the positivist paradigm has been widely adopted by researchers in field of technology adoption and acceptance, who have used scientific methods for collecting data (Legris et al., 2003; Ahmed and Ward, 2016).

2.2 Cloud Computing

Cloud computing is paradigm which combines several existing IT technologies into one service. Most of the IT technologies that are being used in cloud computing are already being used individually, such as virtualisation and Web 2.0, but in cloud computing some of their capabilities are selected to create the cloud environment (Jeffery and Neidecker-Lutz, 2010).

After the announcement of Google and IBM's collaboration in cloud computing in 2007, the expression "cloud computing" became widely popular (Gong et al., 2010). The main reasons behind the migration to cloud computing are cost reduction and flexibility (Wang et al., 20010); for instance, cloud customers can access the cloud anywhere and only pay for the service they use.

Indeed, the work on cloud computing combines different researchers and engineers with different interests. Therefore, each of them might have a different viewpoint, which reflects the diversity of the definition of cloud computing. In addition, the different technologies that are being used in cloud computing, such as Service-Oriented Architecture and Web 2.0, are still evolving (Wang et al., 2010). However, most researchers, such as Buyya et al. (2009), Vaquero et al., (2008) and Wang et al., (2008) agree that cloud computing is an evolving paradigm. Mell and Grance (2009), covered all the essential characteristics of cloud computing by given this definition:

> *[It is] a model for enabling convenient, on-demand network access to a shared pool of 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*.

2.2.1 Cloud Computing Characteristics

The fundamental characteristics that differentiate cloud computing from other computing models are:

- **On-demand self-service**

The cloud can automatically offer services and computing resources for end users at any time without requiring human interaction (Mell and Grance, 2009).

- **Broad network access**

The access to clouds services is via a network and through a various range of devices, such as mobile phones and laptops, depending on the consumer's need (Mell and Grance, 2009; Wang et al., 2010).

- **Resource pooling**

In the cloud environment, the service provider offers a pool of resources to serve consumers based on a multi-tenancy model and the customers' needs (Zhang et al., 2010). Different clients are able to share the same physical resources at the same time using virtualisation technology (Mell and Grance, 2009).

- **Location independency**

The exact location of the data and resources is not specified to end users; it is not necessary for users to know this detail. For example, Microsoft uses a data centre located in Dublin to supply services for clients in the Middle East without indicating this to the clients (Azeemi et al., 2013). However, in some cases the client has the ability to choose the geographic location (Mell and Grance, 2009; Zissis and Lekkas, 2012).

- **Rapid elasticity**

This simply means that the resources can be released rapidly and scaled up or down in a dynamic way and according to users' desires (Mell and Grance, 2009).

- **Pay-per-use**

This feature means that consumers can obtain resources and benefits from cloud according to their needs and only pay for the service they actually use (Zhang et al., 2010). Therefore, this model reduces costs and allows small enterprises to rent resources without any need to set up IT infrastructure in-house (Jeffery and Neidecker-Lutz, 2010).

- **Measured service**

Although computing resources in the cloud are shared by different consumers, the service provider can use accurate service metrics for monitoring, control and reporting the actual usage of cloud service (Dillon et al., 2010; Mell and Grance, 2009).

2.2.2 Cloud Architecture

The architecture design of cloud computing is similar to the Open Systems Interconnection model, consists of four layers namely hardware, infrastructure, platforms and applications layers (Foster et al., 2008). Each layer can evolve separately, because the coupling relation between the layers is loose. The hardware layer is known as the data centre layer, which contains all the core physical resources to build up the cloud computing, such as servers, power and cooling systems. The next layer is the infrastructure layer, also called the virtualisation layer. This layer provides computing resources for end users based on virtualisation technologies. In fact, computing resources are managed and operated in these two layers by the cloud services provider (CSP). The platform layer provides all the necessary requirements for developing applications in the cloud, including operating systems and application frameworks. The application layer is the top layer of the cloud architecture and provides applications to end users. This layer depends on automatic scaling, a feature that ensures availability, and provides better performance at a lower operating cost (Zhang et al., 2010).

2.2.3 Cloud Service Delivery Models

There are three different types of service provided by cloud computing: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS) (Armbrust et al., 2010). In the IaaS delivery model, the cloud offers different types of fundamental resource (e.g., operating systems, storage, networking and database) as a service for consumers, who have the ability to control these resources. However, the users are unable to manage the underlying cloud infrastructure (Mell and Grance, 2009; Chen et al., 2010). Examples of the IaaS model are Amazon's Elastic Compute Cloud (EC2) and GoGrid (Chen et al., 2010).

The second delivery model for cloud computing is PaaS, which provides the whole software lifecycle as a service for consumers (Dillon et al., 2010). In fact, this model is designed to help application or software developers to build and develop their applications on the cloud using different languages and tools. The user in this model has no control over the cloud infrastructure (Zissis and Lekkas, 2012). Google App Engine is an example of the PaaS model (Foster et al., 2008).

The SaaS delivery model allows consumers to obtain applications on demand over the network, based on the pay-per-use model (Chen et al., 2010). The difference between SaaS and PaaS is that the PaaS is able to deliver both completed and in-progress applications, while SaaS can host only the completed cloud applications. Examples of the SaaS model are Salesforce.com and Google Mail (Dillon et al., 2010).

2.2.4 Deployment Models

The cloud deployment models are classified into four types: public cloud, private cloud, hybrid cloud, and community cloud.

- **Public cloud**

This cloud is considered as public cloud, because it provides IT infrastructure and services for the general public or large enterprises. The resources in this type of cloud are owned and managed by the cloud provider. Examples of public cloud include Google App Engine, and Microsoft Windows Azure (Marston et al., 2011).

- **Private cloud**

The private cloud is exclusively offered for a single customer or enterprise. Unlike the public cloud, it can be managed and controlled by a single organisation or a third party provider. In fact, a private cloud is similar to conventional IT infrastructure and does not meet the requirements of modern cloud computing, such as pay-per-use feature, which are essential elements in a public cloud. Amazon Virtual Private Cloud is an example of private cloud (Chen et al., 2010; Zhang et al., 2010).

- **Hybrid cloud**

The term ‘hybrid’ is used when two or more items are combined together. This concept also applies to cloud computing when two or more clouds are merged to attain maximum benefits and cost reductions. For instance, an internal cloud can be utilised inside an enterprise to protect confidential data, while a community or public cloud can be used to attain cost reduction benefit (Jeffery and Neidecker-Lutz, 2010).

- **Community cloud**

Community clouds are mostly developed by group of organisations or people to share their common interests, such as security requirements. The idea of this type of cloud is to provide free or low cost services to customers (Mell and Grance, 2009).

Cloud@home (Chandra and Weissman, 2009) and Nebulas (Cunsolo et al., 2009) are an examples of community cloud.

2.3 Cloud Migration

Cloud migration indicates the process of transferring data, applications or other components from in-house data centres to the cloud. This migration can be done in part of in whole: part of an organisation's system can be migrated to the cloud or all the IT system can be moved to the cloud. Another type of migration happens between clouds; this is called cloud-to-cloud migration.

2.3.1 Benefits of Cloud Migration

There are several benefits and advantages of adopting cloud computing for organisations. Firstly, the cloud can reduce costs and save money for both small and large enterprises because it offers an outsourcing model which allows them to rent resources and pay only for the service that they use (i.e., operational expenditure), rather than building up in-house IT infrastructure (i.e., capital expenditure). Moreover, the maintenance of IT resources and the upgrades are managed by a third party, which allows organisations to transfer responsibility and save money (Armbrust et al., 2010; Buyya et al. 2009; Jeffery and Neidecker-Lutz, 2010).

Another advantage of cloud migration is that it enables enterprises to grow and scale their services easily without delay and according to their specific needs (Marston et al., 2011). For example, sales staff can provide new products and sell them easily and quickly in the cloud environment. Furthermore, by using a cloud environment in organisations, the numbers of IT infrastructure resources, such as servers, will be minimised, and consequently the cost of energy consumption (i.e., electricity) will be reduced (Buyya et al., 2012; Marston et al., 2011). In addition, cloud computing allows the enterprises to run their applications with a minimum failure rate. Finally, the flexibility of delivering computing services is the key benefit that drives organisations to migrate their IT systems to the cloud (Foster et al., 2008).

2.4 A Review of Proposed Approaches to Cloud Migration

This section reviews existing works and approaches regarding migration to cloud computing in order to explore how far the security issues are considered in them.

Khajeh-Hosseini et al. (2010) reported a case study that refers to a legacy migration of an IT system in the oil and gas sector. This study examined the migration of an IT system from an enterprise data centre to Amazon's EC2 (i.e., an IaaS). The cost analysis of the company is presented. In addition, the case study illustrates the possible advantages and risks linked with the migration of the system based on the point of view of managers and other staff, except the security manager and other security experts. In fact, the most important views that need to be taken into account for migration process are those of the security staff.

The study highlights two major risks involved in migration at the organisational level: downsizing and job dissatisfaction. The job dissatisfaction problem occurs due to the high reliance on third party cloud providers because these providers offer 24/7 support. Consequently, firms will downsize the responsibilities of their IT support departments. Their finding indicated that the use of cloud infrastructure will decreases the enterprise costs. Their results are also useful for decision-making purposes as they will help analysts to find solutions to upcoming issues associated with the adoption of a cloud by enterprises. However, their work does not take into account the security aspect. In fact, security is a vital factor in cloud migration and it needs to be considered as an essential element in the migration process.

Khajeh-Hosseini et al. (2011a; 2011b) extended their previous study to develop a toolkit that helps decision-makers and organisations address their concerns during the migration process; the toolkit provides a framework that can be used to evaluate the migration of businesses from an in-house data centre to a public cloud. The first tool consists of a list of questions; this helps enterprises to determine whether a public cloud is a suitable technology for their IT system. The second tool is helpful for the decision-makers in terms of estimating the costs of employing a public IaaS cloud. Their third tool is a spreadsheet that demonstrates the possible risks and benefits associated with an IaaS public cloud from an organisational perspective in general. Their evaluation of the tools based on different case studies focused only on the cost model. Indeed, the proposed methods are a good starting point for risk

assessment and are useful for decision-makers as they cover some issues regarding migration to a public cloud. However, this work only considers the cost of the infrastructure when using one type of cloud (the public cloud).

Klems et al. (2009) proposed a framework to estimate the costs of using IT infrastructure in the cloud. They compared it with conventional IT approaches, such as cost of setting up in-house IT infrastructure or a grid computing service. They dealt with costs in their framework under direct and indirect costs. IT infrastructure resources are an example of direct costs, whereas an indirect cost is incurred by the failure to meet business goals and set up training courses on the new technology. The framework was evaluated based on two case studies. However, their work was in the development phase and therefore the results are not provided. Also, this study did not consider the aspect of security.

Hajjat et al. (2010) proposed a model for the migration of an enterprise's applications to a hybrid cloud. The purpose of this study was to identify the costs and benefits of migrating part of the system to the cloud. The effectiveness of this approach was briefly evaluated based on a case study of the applications migration to the cloud in enterprises. However, this work does not mention how the cost can be computed and only focuses on one type of cloud (the hybrid cloud). They also did not consider the security aspect.

Hu and Klein (2009) have carried out a study to investigate privacy issues during migrating e-commerce applications to the cloud. Their study suggests that the user's data and critical business information must be encrypted during the migration process. The authors have also studied and compared existing data encryption methods in different layers (storage, database, middleware and application). They argue that the middleware layer encryption is the most effective approach for migrating e-commerce applications to the cloud in terms of performance. The evaluation of their work was based on a case study for an e-marketplace application. Indeed, this approach discussed data encryption, particularly for the transmission of e-commerce applications to the cloud. This method helps to ensure privacy of data and provides protection for applications during the migration process. Nevertheless, the authors did not point out how the data and applications will be migrated to the cloud; they also ignored the other aspects of security and privacy that need to be considered.

Hao et al. (2009) proposed a cost model that can be used to determine the type of services

included in migration and their possible location. The model that they developed used a genetic algorithm to provide an effective decision for service migration, by looking for the most optimal migration decisions. In this study, besides considering the cost of service migration, they evaluated the cost of consistency maintenance and communication. It is important to have strong decision support for the infrastructure support, prior to migration. However, the authors omit security in the migration process and they only deal with the security aspect that involves accessing the control process by proposed mutual authentication using certificate authority.

Kaisler and Money (2011) have conducted a study to investigate issues associated with service migration to a cloud, as well as the security problems involved with service implementation. They considered several security challenges. For instance, once a user has decided to change CSP, what happens to the data? Can the users take the data with them? It is noticeable that this study simply lists the possible challenges without any evaluation; it also ignores the security aspects in the migration process. Table 2-1 provides a summary of the reviewed studies that have been conducted regarding migration to cloud environments.

Table 2-1 Summary of the reviewed works about migration to cloud.

Study	**Security Aspect**	**Comments**
Khajeh-Hosseini et al., 2010	Not addressed	This study only evaluated cost using a case study in the oil and gas sector
Khajeh-Hosseini et al.,2011a; 2011b	The possible risks were listed without evaluation	The authors just evaluated cost based on two case studies
Klems et al., 2009	Not addressed	The authors proposed a framework without providing any results
Hajjat et al., 2010	Not addressed	This study briefly evaluated application migration based on a case study but cost computation in this work is not clear
Hu and Klein, 2009	This study particularly discussed data encryption methods	This study evaluated application migration based on a case study without any indication of how applications will be migrated to the cloud. The other security aspects have not been investigated
Hao et al., 2009	This study dealt with the security aspects involved in the access control process	This model was evaluated based on a genetic algorithm to determine the type of services. This study omitted security in the migration process
Kaisler and Money, 2011	The authors listed the possible challenges without evaluation	The security aspects in the migration were not considered

2.5 Technology Adoption Theories

There are several models and theories proposed by researchers to measure the acceptance of a new technology. This section first describes the four main models (the Technology Organisation Environment (TOE) framework, the Diffusion of Innovations (DOI) theory, Institutional theory and the Technology Acceptance Model (TAM)) that have been widely used by researchers to analyse the adoption of IT technology. The next section reviews the models for cloud adoption proposed in different published studies. These studies aimed to identify the factors that have had a major influence on an organisation's decision to adopt cloud computing.

2.5.1 Technology-Organisation-Environment Framework

The TOE framework was proposed by Tornatzky and Fleischer (1990), to analyse the adoption of new IT technologies at an organisational level. This framework investigated the impact of three factors (Technology, Organisation and Environment) on the organisation's decision to adopt a new technology (as shown in Figure 2-1). The technology aspect describes the effect of internal and external technologies of the firm and how adopting new technology can influence the firm (Tornatzky and Fleischer, 1990; Chau and Tam, 1997). The organisational context refers to different measures of the organisation. For example, firm size, scope and complexity of managerial structure. These measures have a significant impact on the adoption decision. Lastly, the environmental context is the field where an organisation runs its business; the industry, competitors and government regulation define the environmental context.

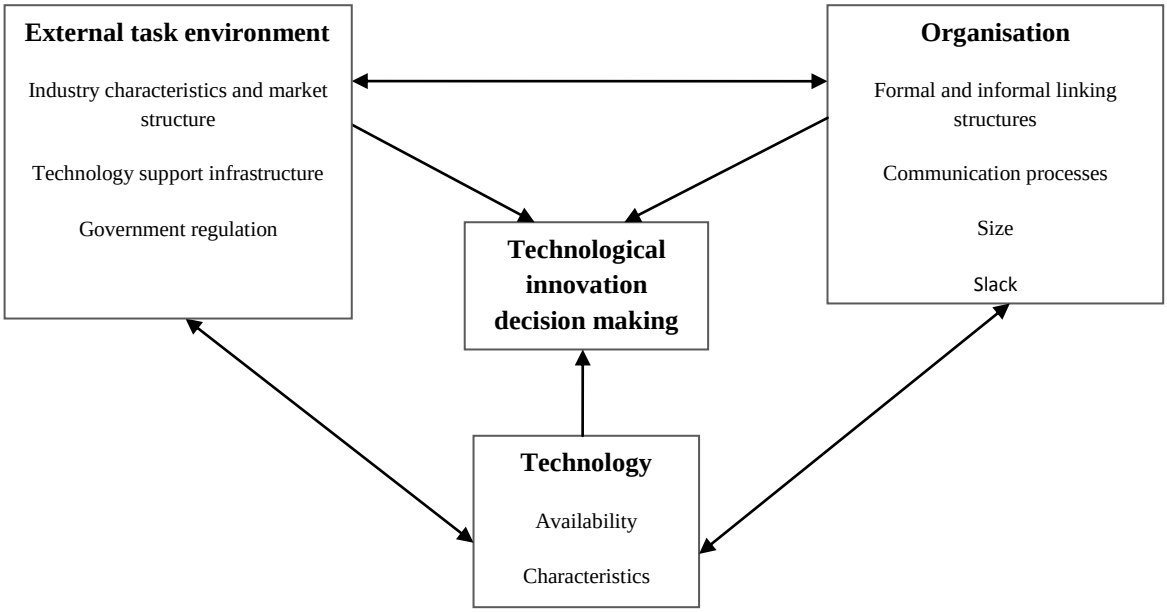

Figure 2-1 TOE framework (Tornatzky and Fleischer, 1990).

2.5.2 Diffusion of Innovation Theory

The DOI theory was developed by Rogers (1995). DOI is a widely used model to explain why and how adoption of new ideas and technologies occurs at individual and organisational levels. The DOI theory posits that there are five technological attributes that have a direct impact on the adoption rate. These attributes are relative advantage, complexity, compatibility, trialability and observability; Rogers (1995) defines these aspects as follows:

- **Relative advantage:** *"The degree to which an innovation is perceived to be better than the idea it supersedes."*
- **Compatibility:** *"The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters."*
- **Complexity:** *"The degree to which an innovation is perceived as relatively difficult to understand and use."*
- **Trialability:** *"The degree to which an innovation may be experimented with on a limited basis."*
- **Observability:** *"The degree to which the results of an innovation are visible to others."*

The decision to adopt technology at an organisational level is more difficult due to the dependence on different views from a number of people at the organisation. Also, the decision of an organisation to adopt technology is affected by different characteristics, such as the leader's characteristics and internal and external characteristics of the organisation. These characteristics are similar to the organisational and technological factors discussed in the TOE framework. However, the TOE framework did not focus on analysing the attributes of technology, as the DOI theory does (Rogers, 1995; 2003).

2.5.3 Institutional Theory

The organisational environment is a vital factor to define institutional structure and actions as institutional theory states (Scott and Christensen, 1995; Scott, 2001). Institutional theory is a common theory used in a number of research studies for examining IT adoption. This theory includes new and important factors in the environmental element of the TOE framework. These new factors are trading partners and competitors, which are external pressures that affect an organisation's decision to adopt a technology. The theory claims that the decision to adopt technology is not only based on internal factors but is also influenced by other factors such as community, culture and legitimacy concerns (Orlikowski, 1993).

2.5.4 Technology Acceptance Model

The TAM was developed by Davis (1989) and is one of the common theories designed for explaining and predicting the acceptance of new technologies at individual level. This model measures users' behaviour in relation the use of new information technology and how far they accept or reject the technology. This theory analyses the impact of two variables (perceived usefulness and perceived ease of use) on the user's intention to use a new technology (Figure 2- 2). The first factor is perceived usefulness, which refers to *"the degree to which a person believes that using a particular system would enhance his/her job performance"* (Davis, 1989). The second factor, perceived ease of use, refers to *"the degree to which a person believes that using a particular system would be free from effort"* (Davis, 1989).

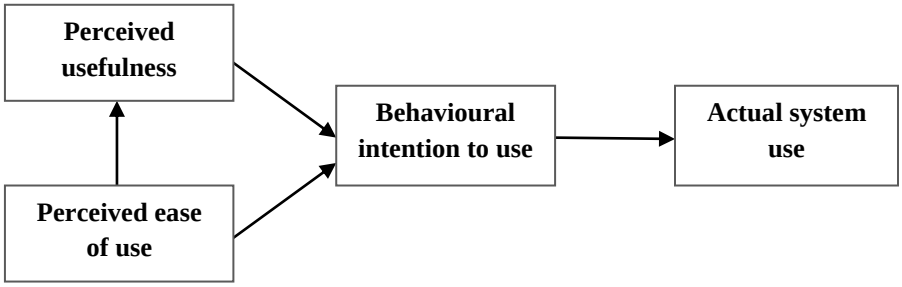

Figure 2-2 TAM model (Davis, 1989).

2.6 A Review of Proposed Models for Cloud Computing Adoption

Low et al. (2011) proposed a model based on the TOE framework. The purpose of this study was to identify the factors and determine their impacts on the decision to adopt cloud computing in higher education in Taiwan. The eight factors identified in this model are relative advantage, complexity, compatibility, top management support, firm size, technology readiness, competitive pressure, and trading partner pressure. Support from top management is an essential factor because they have the ability to execute acceptance of the cloud and create the change. The size of the organisation is another important factor which defined by the number of employees, and the amount of investments (Anand and Kulshreshtha 2007). Technology readiness refers to the degree of readiness of the IT infrastructure and the human resources, which might influences the adoption of new technology (Oliveira and Martin, 2010). The data in this study was collected based on a survey of the higher education industry in Taiwan. The findings indicated that there are five factors – namely relative advantage, top management support, organisation size, competitive pressure, and trading partner pressure – which have a major influence on the decision to adopt cloud computing. A further study was conducted by Chang et al. (2013) based on the TOE framework and DOI theory, aiming to investigate the factors that affect cloud computing adoption in Vietnamese companies. In their study they identified a number of factors, similar to the former study. However, their work has not provided any results because their model was in the initial stage. It is noticeable that these two studies have not considered security factors that might affect the organisations' decision to adopt cloud computing, although security is the one of the main concerns for an organisation that wants to apply new technology.

Also, Nkhoma and Dang (2013) developed a conceptual model using the TOE framework to examine benefits and barriers of adopting cloud computing as well as the impacts of the

environmental and technological variables on the adoption decision. They identified a number of barriers as factors that influence the intention to use cloud computing. One of these barriers is security, which is the main concern for most of the enterprises because storing their data under another party control can makes them feel insecure. Reliability and availability are another two factors. Any errors or delays affects the availability or reliability of the cloud service might cost the organisation a lot of losses. Therefore, ensuring a proper functionality of the system and providing a high quality of service to end users is a key requirement for any organisation. This study identified the compliance with regulations as an influential barrier because the lack of IT standards in the cloud services can obstruct the adoption decisions of an organisation. Also, they examined the extendibility of existing applications and the extent of their compatibility with cloud use and they identified them as influential factors. Moreover, this study investigated the influence of the Adopter's Style (AS). Their results reveal that AS has a major negative impact on the decision to adopt cloud computing whereas the rest of the barriers and benefits have not shown any effect on the adoption decision. Their results are unclear, which indicates that this study needs to re-validate the proposed model and results.

Abdollahzadehgan et al. (2013) analysed only the effect of organisational factors on cloud computing adoption in small and medium size enterprises (SME). They identified three factors (top management support, firm size, and technology readiness) using a TOE framework. These factors are very helpful for organisation to assess their situations if they want to adopt cloud, especially the SME. However, in this study the authors focused on analysing organisational factors and omitted other factors (such as technological, environmental and security factors) that might effect on the organisations' intent to adopt cloud.

Borgman et al. (2013) proposed a model based on the TOE framework to examine factors that influence an organisation's intention to adopt cloud services as well as to identify the impact of IT governance processes and structures. The factors identified in this model are relative advantage, complexity, compatibility, top management support, firm size, competitive pressure, and compliance with regulations. In this study the data were collected using structured interviews. Their findings indicated that only three factors, which are relative advantage, top management support, and competitive pressure, have a positive

impact on cloud adoption. Also, this study ignored the security aspects that might affect an organisation's decision.

Oliveira et al. (2014) developed a model to assess the factors influencing cloud adoption in the manufacturing and services sectors in Portugal. They identified a number of factors based on DOI theory and the TOE framework. In this study the data was collected using a questionnaire with 369 organisations in Portugal. Among the factors examined, their findings showed that relative advantage, complexity, technological readiness, top management support, and firm size directly impacted on cloud adoption in these enterprises. In addition, their results indicated that the drivers of cloud adoption differed in the manufacturing and services sectors. However, this study did not consider other factors that might impact on an organisation's intention, such as privacy and trust.

AlBar and Hoque (2015) developed a model to investigate factors that affect adoption of cloud based Enterprise Resource Planning (ERP) systems in Saudi Arabia organisations. They identified a number of factors using technology adoption theory (TOE framework and DOI theory). However, this study was in the initial stage and did not provided any results. In addition, they did not consider other variables, such as trust, that might influence cloud adoption. Gutierrez et al. (2015) proposed a model using the TOE framework to examine factors that may have an impact on cloud computing adoption in UK organisations. They used a survey for data collection. The factors identified in this study were relative advantage, complexity, compatibility, top management support, firm size, technology readiness, competitive pressure and trading partner pressure. Their findings indicated that only four factors, which are complexity, technology readiness, competitive pressure and trading partner pressure have significant impact on cloud adoption decision. This work also omitted the security factors together with other factors that might influence an organisation's decision to employ cloud technology.

Lal and Bharadwaj (2016) developed a conceptual model and conducted in-depth interviews with 21 Indian organisations which had already adopted the cloud, in order to explore the factors that drive cloud adoption and the effect of cloud adoption on the enterprises' flexibility. Their analysis revealed that relative advantage and top management support played a key role in cloud adoption. This study only focused on analysing factors that drive organisations to utilise the cloud, and omitted other factors, such as security, that may

impeded cloud adoption. They recommend that their results need to be verified through other methods, such as a quantitative method, and that the issue of security should be consider in future research.

2.7 Other Factors that might Influence the Adoption of Cloud Computing in Organisations

The other factors that might have a major impact on decisions regarding cloud adoption in enterprises are:

- **Privacy**

  Organisations that use cloud computing cannot fully control the information that is stored on cloud servers and managed by a third party. This increases the level of risk regarding data confidentiality and might lead to breaches in privacy (Takabi et al., 2010). Privacy is one of the concerns for many organisations that intend to store their data and applications in the cloud.

- **Trust**

  Trust is another issue in cloud computing. The lack of transparency and control over data in the cloud could cause trust problems and this may concern the enterprises. Trust is not just an issue of trusting the cloud provider, but it is also a problem of distrusting the technology itself and its capabilities to provide good service without any interruption or loss of data. Although cloud providers guarantee the provided service to consumers with service-level agreements (SLA), unfortunately this cannot save the reputation of the organisation if any loss or breach of data may happen (Khan and Malluhi, 2010).

- **Physical location**

  The exact location of the data and resources in the cloud could be in anywhere in the world and some of the cloud providers store the data in different countries and hide the exact location from the end user; this can increase an organisation's level of concern about using cloud services. In addition, there are no international policies or regulations for data protection in the cloud. Thus, the physical location is one of the issues that might

affect the organisations' decision to adopt cloud computing (Jaeger et al., 2009; Marston et al., 2011).

2.8 Research Gaps

Cloud computing is beneficial for companies and general users. However, some organisations still have concerns about the idea of shifting a present system to the cloud. A number of researchers in the past have made several attempts to help decision makers address their concerns about cloud adoption. It is noticeable that most of these proposed frameworks and models are focused on identifying the costs and benefits of adopting cloud computing. Moreover, the majority of prior studies have not investigated the security issues associated with migration to the cloud. A few researchers such as Khajeh-Hosseini et al., 2011a; 2011b; Hu and Klein, 2009; Hao et al., 2009; Kaisler and Money, 2011 have attempted to address security problems by studying one aspect, such as privacy, or by listing the possible challenges, without any evaluation. Although the security factor, along with other factors (e.g., firm size and top management support), can has an influence on an organisation's decision to move into cloud computing, only a few studies (Low et al., 2011; Abdollahzadehgan et al., 2013; Chang et al., 2013; Nkhoma and Dang, 2013; Borgman et al., 2013) have been conducted to examine the impact of these factors at organisational level. However, none of these studies has investigated all the factors together, as illustrated in Chapter 3 (Table 3-1). Moreover, there are a number of factors, such as physical location, which may influence the adoption decision of an organisation which have not been examined alongside other factors in previous studies. In fact, the adoption of cloud technology in Saudi Arabia is still in the early stages and to the best of the author’s knowledge, no previous research has investigated the factors that may influence an organisation's decision to adopt cloud computing in the private sector in Saudi Arabia.

2.9 Summary

This chapter started with the background of cloud computing, to understand its basic concepts and essential characteristics. Cloud computing offers resources online according to users' needs; in addition, it allows customers to pay only for the service they use. The resources in the cloud can be released rapidly and scaled up or down in a dynamic way. This chapter also identified the key benefits that drive organisations to adopt cloud computing; some of these benefits are cost reduction, flexibility, and green IT. Furthermore, it has provided a critical review and analysis of the existing work and approaches regarding migration to cloud environments, in order to explore how the security issues are considered in these approaches. Indeed, it clearly appears that most of these approaches have not considered security aspects in the migration. This chapter also addressed existing theories which are used to measure the acceptance of adopting technologies as well as reviewing other proposed models in order to see the possible factors that affect an organisation's decision to adopt cloud computing. In the next chapter the proposed model for cloud computing adoption will be presented.

Chapter 3: Cloud Computing Adoption Model

This chapter presents the proposed model to examine the influential factors on the organisation's intent to adopt the cloud.

3.1 The proposed model

The literature review in the previous chapter clearly shows that only a few empirical studies have examined the influential factors in the decision of adopting the cloud computing at an organisational level. Furthermore, these studies were conducted only on a specific number of factors, and left other influential factors that might affect an organisation's intent to use a cloud service unexamined. As a result, the proposed model combines these factors as illustrated in Table 3-1 to examine their effect on an organisation's decision to adopt the cloud in the private sector in Saudi Arabia. The adoption rate of cloud technology in Saudi Arabia is still low. Therefore, this research proposes an integrated model in an attempt to find out what might encourage an organisation to use cloud services or might impede them from using it. This model integrates the critical factors from the literature review on technology adoption and cloud computing, along with other factors, such as physical location, that have not yet been studied but that may influence the organisation's decision to adopt the cloud. The related factors were extracted and combined, and categorised based on the three fundamental aspects: technological, organisational and environmental factors (Alkhater et al., 2014a). These are illustrated in the cloud computing adoption model Figure 3-1.

Table 3-1 Summary of studied factors that influence adoption of cloud computing.

study	Factors														
	Technological								Organisational			Environmental			
				Quality of service											
	Relative advantage	Complexity	Compatibility	Availability	Reliability	Security	Privacy*	Trust*	Top management support	Firm size	Technology readiness	Competitive pressure	Trading partner pressure	Compliance with regulations	Physical location*
Low et al., 2011 Taiwan	✓	✓	✓						✓	✓	✓	✓	✓		
Chang et al., 2013	✓	✓							✓	✓	✓	✓	✓		
Nkhoma and Dang, 2013			✓	✓	✓	✓								✓	
Abdollahzadehgan et al., 2013									✓	✓	✓				
Borgman et al., 2013	✓	✓	✓						✓	✓		✓		✓	
Oliveira et al., 2014	✓	✓	✓			✓			✓	✓	✓	✓			
AlBar and Hoque, 2015	✓	✓	✓			✓			✓	✓		✓			
Gutierrez et al., 2015	✓	✓	✓						✓	✓	✓	✓	✓		
Lal and Bharadwaj, 2016	✓								✓						

***Note:** privacy, trust and physical location have not been studied in former studies.

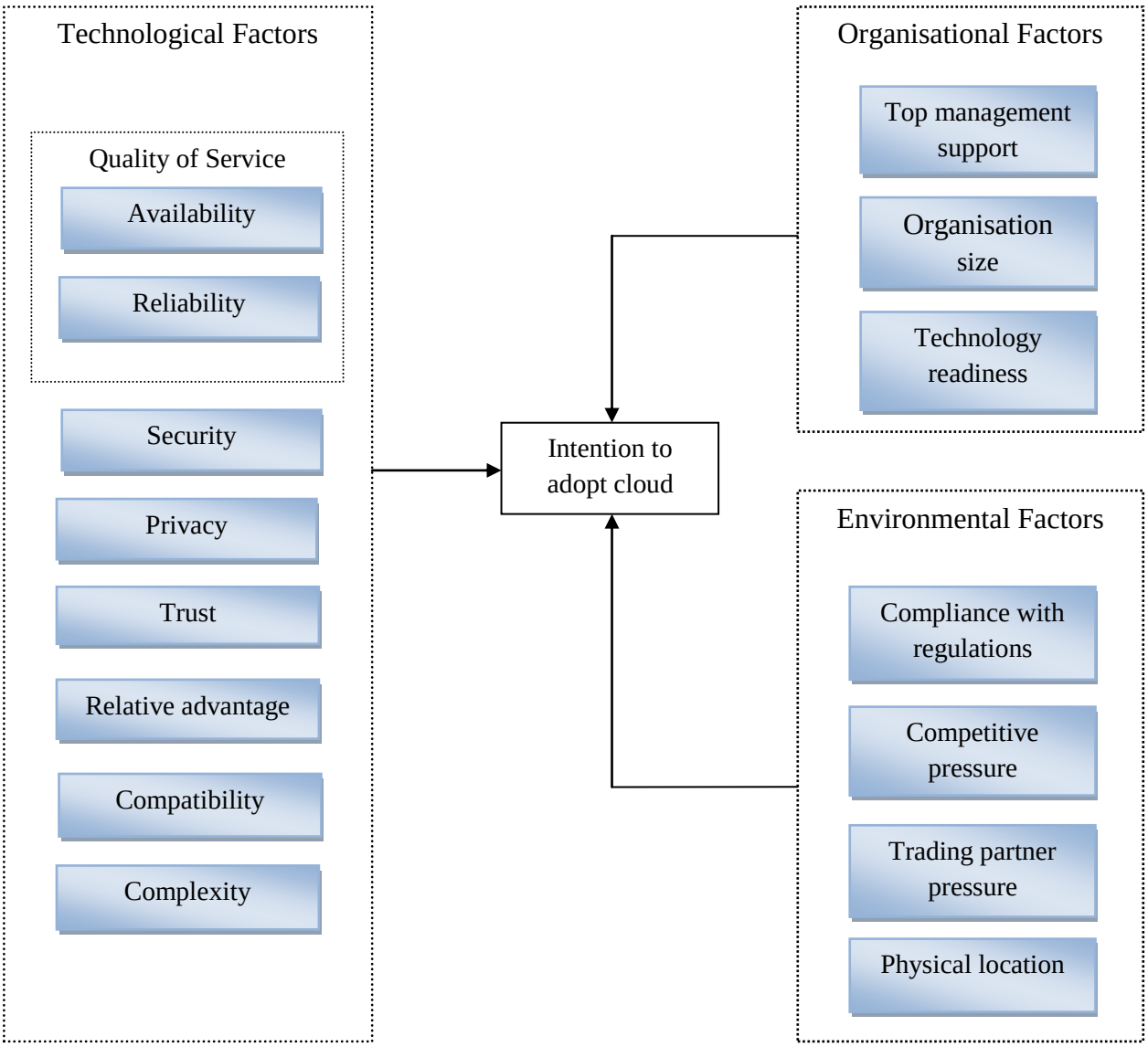

Figure 3-1 The proposed model for cloud computing adoption in private Saudi Arabian organisation.

3.1.1 Technological Factors

This section describes the characteristics of cloud technology and identifies the factors that might affect an organisation's decision to adopt this technology.

- **Quality of service**

The level of quality service to end users has a significant impact on the use of online services (Rahman et al., 2012).Thus, the quality of service is an influential factor in relation to an organisation's decision to adopt cloud computing. Availability and reliability are the elements used to measure of quality of service.

Availability: Cloud computing offers resources online, meaning that the consumer can access the cloud from anywhere and at any time. This means the system needs to function properly and must be available to use whenever it is requested.

Reliability: This refers to the ability of a system to fulfil its intended function in a proper manner as expected. Reliability involves ensuring a high quality of service to end users, with a high transmission rate, minimum rate of errors, and fast recovery.

- **Security**

Security refers to the level of security procedures in place to protect information or the system from unauthorised access or any other security events. Lack of security is one of the biggest doubts for many organisations that intend to adopt the cloud.

- **Privacy**

Privacy is defined as confidentiality of data, where only authorised users can access it. It is the main concern for organisations thinking about cloud computing because when using a cloud service an organisation cannot fully control the information stored on cloud-based servers.

- **Trust**

Trust refers to the reliance on another entity and the belief that this entity will function as expected. Trust in the cloud environment heavily depends on trusting the service itself and the provider to provide a trusted level of authenticity, integrity and confidentiality in regard to the service and the stored data.

- **Relative advantage**

Relative advantage is an element of the DOI model, which is based on the Rogers (1995) model. This factor refers to the level of benefit to an organisation if they decide to move into cloud computing. An examples of these advantages, increase the speed of business communications and flexibility (Armbrust et al., 2010).

- **Compatibility**

Compatibility refers to the ability of the existing application to be compatible with the cloud. The compatibility of a firm's applications with the cloud environment is a real problem that an organisation needs to consider carefully when considering use of the cloud. This factor was identified in the Rogers (1995) model.

- **Complexity**

An organisation normally considers the degree of difficulty involved in using new technology as an important element in their decision before adopting this technology. This factor is also an element of the DOI model. According to Tornatzky and Klein (1982) the three elements of DOI theory (relative advantage, compatibility, and complexity) are the most relevant factors to investigate related to adoption of new technology. Furthermore, cloud providers such as Amazon, Microsoft and Google provide a free trial of their services and offer the opportunity for enterprises to try out and observe the cloud technology before making a decision to adopt it. Thus, the trialability and observability have been excluded in this study and only the three factors of DOI theory have been included.

3.1.2 Organisational Factors

These factors relate to the characteristics of an organisation that might have a significant impact on its decision.

- **Top management support**

Top management play an important role and have a significant impact on the adoption rate of IT innovations at the organisational level. Support from top management is essential because they have the ability to make the change and execute acceptance of the cloud. This change in the organisation needs a supportive decision from top management.

- **Organisation size**

The size of the organisation is another influential factor. The organisation size is defined by the number of employees, the amount of investments, the target market and annual revenue. For example, large organisations are more willing to accept new technologies than small organisations due to their flexibility and ability to accept risk (Pan and Jang, 2008).

- **Technology readiness**

Technology readiness involves measuring the degree of readiness of the IT infrastructure and the human resources in terms of cloud computing. Therefore, organisations that have a good IT infrastructure and skills are more prepared to employ cloud services.

3.1.3 Environmental Factors

The environmental factors determines the environmental elements that might affect an organisation's intent to use cloud technology.

- **Compliance with regulations**

This is an influential factor that can make a firm reluctant to move into cloud computing. This concern comes from the fact that there are no governmental regulations or rules that can support the firm in the event of a data breach. The lack of IT standards is a real problem that might obstruct adoption decisions.

- **Competitive pressure**

Competitive pressure is defined as the degree of pressure that an organisation faces from competitors. In a highly competitive industry, an organisation encounters pressure from competitors to adopt new technologies. This pressure forces some organisations to adopt cloud computing technology and gain a great benefit, more business facilities and better operational efficiency.

- **Trading partner pressure**

Trading partner pressure is another pressure affecting the firm's adoption decision. This pressure comes from vendors or other partners who might adopt cloud computing.

Consequently, this might encourage an organisation to adopt this technology so as to provide a better service for their partners.

- **Physical location**

The physical location is a critical factor that might affect an organisation's decision to adopt cloud computing, for several reasons. Firstly, there are no international policies or regulations for data protection in the cloud. Secondly, some of the cloud providers store the data in another country without indicating this to the end users.

3.2 Summary

This chapter has presented the proposed model for cloud adoption, identifying the key factors that may influence an organisation's decision to adopt cloud computing technologies. The proposed model incorporates the critical factors from the literature review, along with other factors that have not been investigated in previous studies to examine the effect of these variables on the adoption decision of cloud services in the private sector in Saudi Arabia.

Chapter 4: Research Methodology for Exploratory Study

This chapter provides an overview of the research methods used in this exploratory study. The first section provides a brief discussion of qualitative and quantitative research methods, as well as the different tools used in this study. The next section discusses the research methods utilised in this study to refine and confirm the proposed factors in the cloud adoption model. This chapter also explains the calculation of sample size and the techniques for designing questions.

4.1 Research Methods

Two types of research methods can be utilised in this exploratory study: qualitative and quantitative methods. A qualitative method allows the participants to respond to certain questions according to their own perspectives. The qualitative data is usually gathered using an open-ended questions. In this method, the researchers can gain more information about the current situation, human attitudes, opinions and decisions (Creswell and Clark, 2007). This approach can provide more in-depth insights about the subject of study (Anderson, 2010).

The second type of research method is a quantitative method. In this approach the data is gathered through closed-ended questions and the participants are not allowed to explain their answers (Creswell and Clark, 2007). There are various ways of collecting quantitative data such as questionnaires and scientific experiments. By using this approach, the researchers can measure opinions of participants and their decisions; also, different strategies can be used for analysing the numerical data (Mack et al., 2005).

Mixed methods is a combination of quantitative and qualitative methods. By combining the two methods, researchers can gain more knowledge and more accurate results and provide a clearer picture of the problem (Ghauri and Grønhaug, 2005). According to Mack et al. (2005), some researchers used qualitative methods to gain a wide view of the problem and deep understanding of the results collected through quantitative methods. In this study different techniques can be used to collect qualitative and quantitative data. Therefore, the next section discusses the tools that will be applied in this exploratory study.

4.1.1 Interview

The interview is one of the common tools usually used for collecting qualitative data. Also, it can be employed with quantitative research methods (Oishi, 2003). By using interviews as a research method a researcher can explore more knowledge in the area of study. The flexibility of interaction between the interviewer and participants during an interview can avoid participants misunderstanding any questions. However, the researcher may face difficulties in finding participants in the study (Oppenheim, 1992). The interviews can be conducted over telephone and face-to-face or online (Rogers et al. 2011). The interviews are classified into four types: structured interviews, unstructured interviews, semi-structured interviews and focus groups (Britten, 1995; Rogers et al., 2011). With structured interviews, the interviewer usually uses the same questions (closed-ended questions) for collecting data from each participant. An unstructured interview consists of a set of open questions and this technique is the opposite of fully structured interviews, unstructured interview allows a researcher to explore more important information in detail (Britten, 1995). The third type is called semi-structured interviews, which combine closed- and open-ended questions. In this type the questions are prepared prior to the interviews and the interviewee can be asked more questions to explain more information in detail during the interview (DiCicco, 2006). The fourth type is a focus group, which is defined as a discussion among at least three people about a specific topic (Rogers et al., 2011).

4.1.2 Expert Review

An expert review is a simple method that enables researchers to collect data from experts who have knowledge of the topic under study. This technique can be used in quantitative, qualitative or mixed methods at different stages of the study (Tessmer, 1993). The expert can give their opinion or any suggestions to improve any points in the study. The expert review technique provides an opportunity for a researcher to reach people who have wide experience in the area of study rather than novices and gain more information and recommendations regarding the subject of study. However, this an expensive task to conduct in some cases (Ramirez, 2002).

4.1.3 Questionnaire

The questionnaire is one of the tools which is usually used for collecting quantitative data (Saunders et al., 2009), but also can be used to collect qualitative data when it contains open-ended questions (Oppenheim, 1992; Engel and Schutt, 2005). There are two ways of conducting a questionnaire: self-administered, where the participants answer the questions by themselves, and the second one, interviewer-administered, where the researcher records the participants' answers themselves (Bourque and Fielder, 2003). The questionnaire can be distributed through online tools or on paper (Rogers et al., 2011). One of the key benefits of using a questionnaire as a research tool is that this technique enables the researcher to collect a large amount of data in a short time across the world in a relatively cost effective way. However, the researcher may face difficulties in control over data, especially in an online questionnaire, and this is a time consuming task (Oppenheim, 1992).

4.2 Triangulation

Triangulation is a technique, which is defined as a combination of two or more methods in a study. The key benefit of this technique is helping researchers to understand problems in an extensive way and increase confidence and accuracy of research findings (Thurmond, 2001). There are four types of triangulation techniques, which are data triangulation, investigator triangulation, theoretical triangulation and methodological triangulation (Denzin, 1970; Bryman, 2004; Runeson and Host, 2009). Data triangulation means the data is collected from various sources and different people at different places and times. This approach can be utilised in qualitative research methods such as focus groups and in-depth interviews (Guion et al., 2011). The second type is investigator triangulation. This technique involves gathering and interpreting data by utilising more than one researcher in the study field. In this technique each investigator will use the same qualitative research method (e.g., case studies, interviews, observations or focus groups) to collect data from participants. Then the results from each researcher are compared to provide a strong conclusion. However, if there is a conflict in the results between researchers, further study is needed to address this issue (Guion et al., 2011). Methodological triangulation is a common approach usually used by a researcher. This technique means the data have been collected using different research methods (i.e., quantitative and qualitative methods). Then in this approach, the results from each method would be compared to see if they provide similar conclusions (Guion et al.,

2011). The fourth type is theoretical triangulation, which means the data has been interpreted by using more than one theoretical perspective (Denzin, 1970).

4.3 Research Methods for this Study

This exploratory study utilised both qualitative and quantitative methods. In order to improve the proposed model for cloud adoption in Chapter 3, the author decided to use mixed methods in this study. According to Tashakkori and Teddlie (2010), utilising mixed methods enables researchers to meet their goals as well as increasing the confidence of the research and reliability of results. So, in order to improve the model and increase the precision of the research, the main steps of this research were subject to the triangulation method (i.e., theoretical triangulation and methodological triangulation).

Theoretical triangulation, based on the literature review, has been proposed as the initial model. This model integrates critical factors from the literature review along with other factors that have not been investigated in any previous studies, so as to examine the impact of these factors on the adoption decision of enterprises.

Methodological triangulation in this research has been applied by using two methods, interviews (expert reviews) and questionnaires. Expert reviews involve interviews and discussions with IT experts from different organisations in the private sector in Saudi Arabia. Semi-structured interviews were used for this task, which combined closed- and open-ended questions. The purpose of the interviews was to assess the importance of the proposed factors on an organisation's intention to use cloud services as well as to identify other factors that were not mentioned in previous studies. Furthermore, in order to confirm the proposed model for cloud adoption, a quantitative research method was used in this study. The data were collected from self-administered questionnaires. The aim of the questionnaire was to confirm the factors that already exist in the cloud adoption model and the other factors that were collected from the interviews. Figure 4-1 illustrates the triangulation method that has been used in this study.

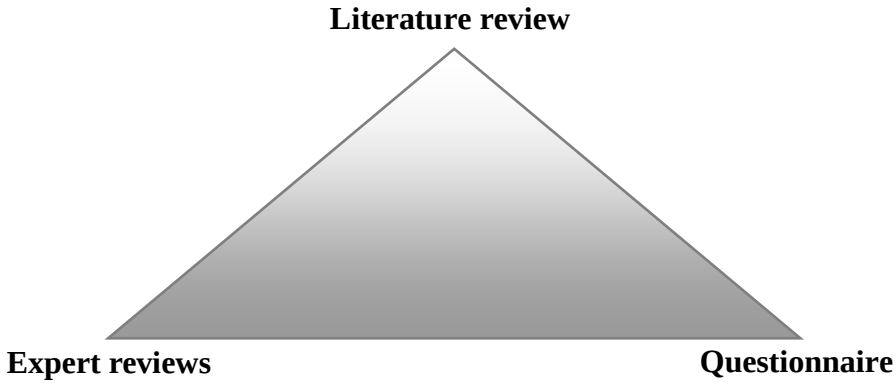

Figure 4-1 Triangulation technique for confirming the proposed model.

4.4 The Sample Size

It was important to identify the sample size before conducting this study. In order to determine the minimum sample size, G*Power software was used. G*Power is software that enables researchers to compute the required sample size and also increase the accuracy of their results (Field, 2009). The parameters identified to compute the minimum sample size were as follows:

- Effect size: According to Cohen (1988), there are three parameters for effect size small, medium and large. The appropriate effect size for this exploratory study is 0.8 (i.e., large).
- Type I error, also known as alpha (α): for 95% confidence level $\alpha = 0.05$. This means the probability of rejecting the null hypothesis when it is true is 5% (0.05). Type one error means false rejection of the null hypothesis.
- Type II error (i.e., 1-β err prob): Type two error indicates that the null hypothesis will not be rejected when it is actually false (Banerjee et al., 2009). In other words, type two error means false acceptance of the null hypothesis. This is conventionally set at 20%.; so (1-β err prob) = 0.8.

In this study the calculation was performed under a t-test family (one sample case). The results indicated that the minimum sample size for the questionnaire was fifteen participants. Table 4-1 illustrates the statistical calculation of the sample.

Table 4-1 The sample size calculation using the G* Power software.

Statistical test	Means: Difference from constant (one sample case)
Tails	Two
Effect size d	0.8
α error prob.	0.05
Power (1–β err prob)	0.8
Minimum sample size	15

In terms of interviews, there is no typical sample size for data collection from interviews; thus, there is no set number for participants in interviews. However, Creswell (1998), recommends that from 5 to 25 interviewees is acceptable, while Morse (1994) suggests that six is the minimum for participants in interviews. Furthermore, Thomson, (2011) conducted a review of one hundred studies regarding sample size in interviews and found that the point at which any increase in number of interviews will lead to repeated material and data saturation occurs between 10 and 30 interviews (Thomson, 2011). Strauss and Corbin 1998 also state that the saturation of data is dependent on a researcher's decision. In this present study, the researcher has taken into account these suggestions and conducted interviews until there was no new data to be added to the study.

4.5 Interview Design

The aim of the semi-structured interviews was to review factors that were identified in Chapter 3. Another objective was to identify other factors that were unstated in previous studies. The interview questions were prepared prior to the interviews and included closed- and open-ended questions. According to Foddy (1993), the five-point Likert scale is the optimal choice for cases that require decisions; Lietz (2008) also mentioned that this scale can increase reliability and validity of results. Therefore, in this study the closed-ended questions were designed using a five-point Likert scale: (very important = 5; important = 4; may be important = 3; not important = 2 and not relevant = 1). The other questions were open, which helped the researcher to understand an organisation's requirements and attitude toward cloud adoption as well as to explore other important factors. Table 4-2 provides an overview of interview questions. The interview questions were developed in the English language and also were translated into Arabic. To ensure accuracy of the questions, pilot interviews were conducted with three researchers at the University of Southampton as well

as with one researcher in computer science at Kings College London, to test the clarity of the questions. The interview questions were modified based on the pilot interviews, including rewording and deleting some unclear questions. The English versions of interview questions are provided in Appendix A.

Table 4-2 The interview questions.

Number	Questions
Q1	How important are the following attributes to the adoption of cloud computing services? Followed by a list of the identified factors in cloud adoption model: • Quality of service (Availability and reliability), security, privacy, trust, relative advantage, compatibility and complexity. • Top management support, organisation size and technology readiness • Compliance with regulations, competitive pressure, trading partner pressure and physical location.
Q2	In your opinion, what other important factors need to be considered when an organisation intents to adopt cloud computing?
Q3	Does your organisation adopt cloud computing?
Q4	What are the reasons behind using/not using cloud computing in your organisation?
Q5	What are the challenges that your organisation faced with using cloud computing? (If your organisation adopted cloud computing answer this question)

4.6 Questionnaire Design

In order to confirm the proposed model for cloud adoption, a self-administered questionnaire was designed for this study. The aim of the questionnaire was to confirm the factors that already exist in the cloud adoption model, except the "trading partner" factor, as well as the other factors that were identified from interviews with IT experts. The questionnaire was divided into two sections: demographic information and 28 closed-ended questions concerning seventeen factors. These factors are quality of service (availability and reliability), security, privacy, trust, relative advantage, compatibility, complexity, trialability, top management support, organisation size, technology readiness, compliance with

regulations, competitive pressure, physical location, external support, industry, and culture. The reason that there were 28 closed-ended questions, was because some factors were measured by more than one question. For example, trust has two questions one measuring trust in the technology itself and the other one about trust in the cloud provider. The closed-ended questions were designed based on findings from the interviews and using a five-point Likert scale: (strongly agree = 5; agree = 4; neutral =3; disagree =2 and strongly disagree = 1).The questions used were as follows:

1. Cloud services should be available to support our IT operations.
2. The reliability of cloud technology has an impact on our decision to use it.
3. Security is an important factor when it comes to cloud computing.
4. Security concerns affect our decisions to use cloud services.
5. Privacy is a critical issue that affects our decision to use cloud services.
6. Cloud computing technology is trustworthy.
7. Storing our organisation's data under third-party control is a concern of ours.
8. The use of cloud computing in our organisation will help us to reduce costs.
9. Cloud computing services will help us to accomplish tasks quickly.
10. The compatibility of cloud technology with our work style has a direct impact on our decisions to use cloud services.
11. Cloud technology is still complex.
12. It is essential to try cloud computing before using it in our organisation.
13. Management approval is essential before the cloud can be adopted in our organisation.
14. Organisation size needs to be considered before using cloud technology.
15. Technical knowledge is essential to adopt cloud computing.
16. Having skills to use cloud technology is essential.
17. Having strong technical infrastructure (e.g., high bandwidth) would encourage us to use cloud computing.
18. Having a high speed of Internet would encourage us to use cloud computing.
19. Compliance with regulations affects our decision to use cloud services.
20. If our competitors adopted cloud computing, it would encourage us to use cloud services in our organisation.
21. It is important to know where the cloud providers will store our data.
22. Storing our data in a cloud that runs in a different country could lead to the issue of compliance with regulations.

23. Storing our data in a cloud that runs in a different country has an impact on the privacy of data.
24. Knowing the physical location is not important as long as the cloud provider ensures the security of our data.
25. Knowing the physical location is not important as long as the cloud provider ensures the privacy of our data.
26. Support from the cloud providers is essential for using cloud services.
27. Using cloud technology depends on the nature of business in the organisation.
28. The cultural aspect is an important factor that should be taken into consideration when we use cloud technology.

The questionnaire was administered in both Arabic and English. In order to ensure clarity of questions, the questionnaire was checked by four researchers at the University of Southampton. This review was useful in reformulating some questions and improving the content of the survey. In this research, Google Drive was used to develop an online questionnaire. The link to the questionnaire was distributed via email to IT staff working in different private organisations in the eastern province of Saudi Arabia. Appendix C provides the English version of the questionnaire.

4.7 Ethical Approval

Before conducting interviews with IT professionals and distributing the survey to participants, ethical approval form was submitted to the Ethics Research Governance Online (ERGO) committee at University of Southampton to obtain approval. The reference number for interviews was 9708 and for the questionnaire was 12941.

4.8 Summary

This chapter started with a brief discussion of qualitative and quantitative research methods. In order to refine and confirm factors relating to cloud computing adoption this study utilised mixed methods (i.e., methodological triangulation). Semi-structured interviews were used in this study, which included closed- and open-ended questions. The objective of interviewing IT experts was to review the proposed factors and to identify further factors related to Saudi

Arabia's environment. In this study quantitative methods were utilised to design the questionnaire. In order to confirm factors for cloud adoption, the survey were designed using closed-ended questions with a five-point Likert scale. Furthermore, in this study the sample size was calculated using G*Power software and the result was 15 participants. The next chapter will presents the results of the interviews and questionnaire.

Chapter 5: Results and Discussion

This chapter presents the results of the mixed methods utilised in this study, in order to refine and confirm the proposed factors in the cloud adoption model. The first sections in this chapter present the findings from interviews with IT experts. It also discusses the results of the questionnaire that was conducted with different organisations in the private sector in Saudi Arabia.

5.1 The Results of the Interviews

This section presents the results of the interviews (expert review). The data was collected using semi-structured interviews with twenty IT experts working in different private organisations. The aim of this stage of the research was to review the factors identified previously in Chapter 3 and explore other factors that are not mentioned in previous studies, before carrying out the survey. The results of the interviews with IT experts are divided into three sections: demographic information, quantitative data and qualitative data.

5.1.1 Demographic Information

The interviews were conducted with twenty IT experts at different organisations in Saudi Arabia. All the participants were working in IT departments in different sectors (such as manufacturing, engineering and energy), in large organisations and SME. All participants had at least five years' working experience, so they had the ability to understand the current situation of their organisation and future trends. The interviews were carried out between April and May 2014, at the experts' workplaces (i.e., face-to-face interviews), and they were recorded using a recording device with the permission of the experts. Seven of the participants in this study are working in companies that already have adopted cloud computing while thirteen (65%) of them are not. Table 5-1 presents the percentage of adoption of cloud computing at the participating companies. For more information about organisations and experts participating in this study see Table 5-2.

Table 5-1 Percentage of adoption of cloud computing.

Q- Has your organisation adopt cloud computing?		
Variable	Frequency	Percentage
Yes	7	35%
No	13	65%

Table 5-2 An overview of experts taking part in this study.

Experts	Position	Adoption stage	Industry	Market scope	Size
A	Network Consulting Engineer	Adopter	Information Technology	International	Large
B	Manager of IT Business Support Applications	Adopter	Petrochemical	International	Large
C	IT Manager	Adopter	Engineering	International	Large
D	IT Consultant and System Support Engineer	Adopter	Manufacturing	International	Large
E	IT Business Office Leader	Adopter	Chemicals	International	Large
F	IT Manager	Adopter	Petrochemical	International	Large
G	IT Manager	Adopter	Construction and engineering	International	Large
H	IT Manager	Non-Adopter	Machinery and equipment	Local	SME
I	Head of IT Department	Non-Adopter	Oil and gas	International	Large
J	Senior IT Engineer	Non-Adopter	Industrial manufacturing	Local	SME
K	IT Manager	Non-Adopter	Heavy Industries	Local	SME
L	IT Manager	Non-Adopter	Engineering	Local	SME
M	IT Engineer	Non-Adopter	Engineering	International	Large
N	IT Manager	Non-Adopter	Travel	International	Large
O	IT Engineer	Non-Adopter	Manufacturing	Local	SME
P	IT Manager	Non-Adopter	Retail	Local	SME
Q	IT Engineer	Non-Adopter	Manufacturing	Local	SME
R	IT Infrastructure Section Head	Non-Adopter	Petrochemical	National	Large
S	IT Manager	Non-Adopter	Energy	National	SME
T	IT Manager	Non-Adopter	Retail	Local	SME

5.1.2 Quantitative Data

This section provides the results of the quantitative data. The interviewees were asked for their opinion about all the proposed factors in Chapter 3 using closed-ended questions. The aim of the questions was to assess the importance of the proposed factors to an organisation's intention to adopt cloud services, from the experts' point of view. The collected data was analysed using Statistical Package for the Social Sciences (SPSS) software and tested using the one-sample t-test. The test value was defined as 3 on the five-point Likert scale, which ranged from 5 (very important) to 1 (not relevant). The results are presented in Table 5-3. The percentage of participants' responses to closed-ended questions are presented in Appendix B. In this study Bonferroni correction was used for controlling false positive results, by dividing alpha (α) by the number of factors included in the questionnaire = (α/n) 0.05/15 =0.0033. Therefore, the factor is only statistically significant if the p-value < 0.0033 (Alkhater et al., 2014b; 2015a).

Table 5-3 The analysis of the expert review using a one-sample t-test.

Q- How important are the following attributes to the adoption of cloud computing services?				
Factors	N	Mean	Sig. (2-tailed)	Result
Availability	20	4.75	<0.001	Statistically significant
Reliability	20	4.90	<0.001	Statistically significant
Security	20	5.00	<0.001	Statistically significant
Privacy	20	4.75	<0.001	Statistically significant
Trust	20	4.60	<0.001	Statistically significant
Relative advantage	20	4.60	<0.001	Statistically significant
Compatibility	20	4.20	<0.001	Statistically significant
Complexity	20	4.00	<0.001	Statistically significant
Top management support	20	4.80	<0.001	Statistically significant
Organisation size	20	3.75	.003	Statistically significant
Technology readiness	20	4.15	<0.001	Statistically significant
Compliance with regulations	20	4.85	<0.001	Statistically significant
Competitive pressure	20	3.65	.008	Not statistically significant
Trading partner pressure	20	3.40	.148	Not statistically significant
Physical location	20	4.15	<0.001	Statistically significant

Based on the experts' opinions, the results in the above table indicate that the means of all proposed factors are greater than a defined value, which is 3. Furthermore, the inferential analysis of responses to these questions shows that the factors are statistically significantly

important, except the competitive pressure factor and trading partner pressure factor, where the p-value is greater than 0.0033.

- Competitive pressure factor: (0.008 >0.0033).
- Trading partner pressure factor: (0.148 >0.0033).

Although the result shows that the competitive pressure factor has no significant impact on the organisation's decision, the findings from former studies indicate that this factor has a major influence on the decision to adopt cloud computing (Low et al., 2011; Borgman et al., 2013). Consequently, the competitive pressure factor will be kept in the proposed model and trading partner pressure factor will be removed.

A further analysis was conducted to see if there was a difference between organisations that had adopted cloud services and non-adopters. The result shows that there are no statistically significant differences between adopters and non-adopters regarding the importance of the proposed factors on an organisation's decision to adopt cloud services (0.186 > 0.05).

5.1.3 Qualitative Data

This section discusses the findings of the qualitative data from the expert review. This stage aims to identify other factors relating to adoption of cloud services in private sector in Saudi Arabia from the experts' view. NVivo software was used for analysing and coding experts' responses. The other influential factors that might affect an organisation's intent to use cloud service were coded under the following headings: trialability, external support, industry, and culture.

Trialability: Some of the experts believe that it is essential for an organisation to try cloud technology before implementing it; this will help enterprises to understand the way technology works and if it meets their needs. Here are some quotes of experts:

Expert O: *"Test resources before undertaking migration, when we are taking a migration we need to take the important things and test resources. For example, how cloud computing works, how much space they are offering, and if it's suitable for us."*

Expert S: *"I think we need to try the cloud services before adopting it, that we call it a test phase."*

External support: The availability of external support is also an important factor impacting on the adoption decision. In this exploratory study, most of the experts mentioned that they need 24/7 support from the cloud provider side to meet their needs; besides this, the cloud provider should support the future plan of the organisation. Expert F also emphasised that getting the vendor to support and update the service to meet the requirements is one of the challenges that their organisation faced with using cloud computing. Furthermore, one participant believed that the support from governments is essential to encourage adoption of cloud service in this country. This factor is illustrated in the following examples.

Expert J: *"Regional Support: the service provider should offer 24/7 technical support with proper training. This is the main point, whether we are paying for hardware, software or service. We need to have a service provider near to us."*

Another interesting point stated by **Expert J:**
"The service provider should be ready with infrastructure that supports the customer's future upgrades and service provider infrastructure should not limit the customer's ability for upgrades or new application implementation."

"We need external support- 24/7 support from the service provider" **(Experts O, R and T)**.

Expert I: *"We need to have government buy-in to adopt cloud computing."*

Industry: From an expert perspective, cloud computing is more suitable for sectors that depend on IT technology. Therefore, the organisation needs to consider the nature of its business and its requirements before adopting cloud service. The following examples will explain this factor.

Expert E: *"An organisation needs to understand its desire to be on the cutting edge of technology. I think the important thing to recognise who is your company. We are a chemical company, so we are not an IT company, and may not have a high desire to be on the cutting edge technologically."*

Expert H: *"We are not an IT company, we are industrial company, and usually in our industry the assets purchasing will occur over four years."*

Expert T: *"The nature of work needs to be taken into account before adopting cloud computing."*

Culture: The cultural aspect is also an important factor that should be taken into consideration. Culture is defined as the *"beliefs, values, habits, norms and behavioural patterns of a group of people in a community"* (Leung et al., 2005). The analysis reveals that culture has an impact on the adoption decision. One of the participants stated that while cloud technology might reduce the number of jobs in an organisation, it provides an opportunity for jobs in the country that hosts the services, where the need in this country is to create job for community and rise economy.

The other factors influencing use of cloud computing technology that were mentioned by participants (security, privacy, trust, compliance with regulations, technology readiness physical location, relative advantage, and compatibility) already exist in the proposed model (Chapter 3). It is interesting to note that security, privacy and trust issues are the big concern for most organisations participating in this study and were the main reasons behind their decision to not adopt cloud services. Also, compliance with regulations is an important factor impacting cloud adoption. One of the participants stressed that their organisation decided to adopt cloud computing on a limited scale only due to security, privacy issues and legal compliance. Table 5-4 illustrates the reasons behind not adopting cloud service at the participating companies.

In terms of technology readiness, the access to cloud services depends on internet connectivity. Therefore, the good internet connection, high bandwidth and speed of internet play an important role in an organisation's decision to employ cloud services. It is interesting to note that most of the participants in this study were concerned about internet connectivity and speed, and this was one of main reasons behind not using cloud computing in their organisation. This is due to the fact that the internet infrastructure in Saudi Arabia is still under development stage, beside that the cost of internet service is very high compared to other countries (e.g., Europe and America). According to expert G, increase internet bandwidth is the main challenge that faced their organisation. The following examples will explain this issue.

Expert H: *"Connection speed or bandwidth is one of the technical issues that prevent us from taking this service. In Europe and the US the technology of communications is really different from here. Here still certain areas depend on normal digital subscriber line (DSL) modems."*

Expert J: *"It depends totally on your link to the internet. So if your internet connection disconnects for some reason it means you lost the access to your data, your email, your files and all service hosting in the cloud is not able to access them."*
Other reasons stated by **Expert J:**

"Speed and bandwidth issue. For medium and large companies this could be a real issue For example, now I have my mail server in house if I receive an email with five people in Cc. I have to download it once but in the cloud every client will download the email. So six times."

The other participants' responses that demonstrate this issue:

Expert K: *"The internet speed is not good and cost is high to get the desired speed. The other thing cloud needs is very high bandwidth; without good internet we can't adopt cloud computing."*

Expert M: *"We are not able to adopt cloud computing because here in Saudi Arabia the network connectivity is very poor, not stable. We already using fibre-optic but it is still not reliable, very poor, unlike in the US or Singapore whose network connection is very stable."*

Expert N:*"One of the main reasons: to use the internet or fully depend on it, the Internet cost is too expensive compared to other regions and in this region particularly the Internet infrastructure is not good compared to other regions like America and Europe; they have very good infrastructure plus the cost is less. Here the cost is high and infrastructure not much good."*

Expert T: *"The technical issue (connection speed) is one of the issues preventing us from adopting cloud computing."*

In terms of physical location, some experts stated that there is a link between the physical location of data and the compliance with regulations because some cloud providers store data in other countries without indicating this to their end users, and this could lead to compliance issues and privacy concerns. For example, **Expert J** stated that:

"Compliance with regulations is also one of the concerns. When you are outsourcing your hardware and your service, you don't exactly know where your information is. It could be in the US, China or India. Then privacy will come into the picture. For example, in some country's regulations, they have the full right to see your information, and some company they don't like this."

However, some of the participants believed that the physical location is unimportant as long as there are security measures in place and the cloud providers ensures the privacy of the organisation data. The examples below illustrate this point:

Expert C: *"We have a security agreement with the company. So, the physical location depends on security. If it secure, no problem."*

Expert N: *"Wherever their location is it not important for me. What is important for me is their infrastructure. What kind of infrastructure is it? If there is security and privacy there, I don't mind wherever the physical location."*

The other issue that was mentioned by experts is about costs. Although the cost reduction is one of the main advantages of cloud computing and some of the enterprises who have already used cloud technology were aware of this advantage (see Appendix B), the analysis reveals that the cost of moving to cloud computing is not an efficient option for some organisations and this was one of the reasons behind their decision to not adopt cloud service. The participants said that the cost will be high or in the best cases similar to the cost of maintaining the data in house. Also, one expert whose company has already adopted cloud computing asserted that the organisation needs to consider cost not only for the short term but also for long term. The examples below illustrate this issue.

Expert B: *"Cost is the basic thing. If we spend now one million on our data centre why would we pay three million to make it outsourced or cloud service."*

Expert H: *"First of all, we are SME. The cost for this technology is on an annual basis. So one of the main reasons is that it is still new technology. For any new technology the preliminary cost will be expensive if you compare it with purchasing the asset itself. We are not an IT company, we are an industrial company, and usually in our industry the assets purchasing will occur over four years and if we are looking in this way the cost will be double the asset itself."*

Expert J: *"The first reason is the cost. We found that in many scenarios, the cost involved in moving to cloud computing is almost the same as maintaining our own servers in the company's data centre. We have a small study about implementing cloud computing. We found that in three years we are going to spend almost half a million Saudi riyal whereas if we are going with the traditional way we will spend almost* two hundred *thousand Saudi riyal. So big savings if we keep the service in house."*

Expert K: *"The cloud computing cost is very high and for a medium sized company it's not recommended."*

Moreover, the experts suggested some other important factors that need to be considered before adopting the cloud, but most of them have already been discussed in the proposed model, such as cost savings, compatibility and availability of cloud service. For more information about the factors suggested by experts (see Appendix B).

Table 5-4 The reasons behind not adopting cloud in the organisations.

Themes	**Codes (Factors)**
Security issue **(Experts J, O and T)**.	Security
I think the security issue is the big concern. The company is still hesitant about the security of the data offered by the cloud vendor **(Expert L)**.	
We didn't use it because it's not secure these days **(Expert Q)**.	
Security is the main concern **(Expert S)**.	
Trust issue: simply when the data is offsite we can't be sure where it is. And what if any government agencies will be accessing the data **(Expert J)**.	Trust
Trust issues: Our data is important; if we are migrating this to a cloud system the third party will see all the data and everything **(Expert O)**.	
Our data will be with someone else **(Expert Q)**.	
Data privacy issues could arise, if your cloud provider seek to monetise the data in their system. You have given them all our personal data **(Expert P)**.	Privacy
Privacy is the main concern **(Expert S)**.	

Themes	Codes (Factors)
No rules or regulations govern such direction and this is one of the reasons behind not adopting cloud service in our organisation, as result we need to update our rules and regulations to comply with cloud computing **(Expert I)**.	Compliance with regulation s
Compliance issues could rise the risk of using cloud computing **(Expert O)**.	
We decided not to use application hosting in the cloud because the application data is considered intellectual property, and we want to keep it in Saudi Arabia, and train our own workers to manage it. This reduces the risk of the intellectual property being publicised or illegally infiltrated **(Expert E)**.	
Compatibility issue: the reason particularly for our organisation is compatibility of our application because there are some local applications that we are running that are not compatible with cloud computing **(Expert N)**.	Compatibility
Licence issue. We are worried about the cloud system. Not clear about the licence issue **(Expert L)**.	
Data residence outside the country **(Expert R)**.	Physical Location

5.2 The Results of the Questionnaire

This section presents the results of the online survey. The data was collected using an online questionnaire from 30 IT staff who were working in different organisations in the private sector in Saudi Arabia. The aim of the questionnaire was to confirm factors that already exist in the proposed model and other factors that were identified from the interviews. The results of the questionnaire are divided into two sections. The first section relates to demographic information and the second section presents the results of closed-ended questions regarding 17 factors (Alkhater et al., 2015b).

5.2.1 Demographic Information

The online survey was conducted between November and December 2014 with 30 IT staff in different organisations in the private sector in Saudi Arabia. Although the questionnaire was distributed in both English and Arabic, all the participants chose to answer the questionnaire in English. Table 5-5 illustrates the demographic information, which includes organisation size, industry, market scope, adoption stage and the organisation's intention to adopt cloud services in the future. In order to determine the organisation's size, the participants were asked to specify the number of employees in their organisations. The majority of the participants were working in large organisations (73.3%), whereas only 20% of the respondents were working in medium-sized enterprises and 6.7% in small enterprises.

Although the questionnaire was randomly distributed online to IT staff most of the participants were from engineering sectors, representing 23.3% of the sample, followed by the manufacturing, petrochemical and IT sectors (13.3%). This was to be expected in a region like the eastern province of Saudi Arabia, which is home to the largest petroleum and manufacturing companies. In terms of market scope, most of the participating companies in this study were international (73.3%), followed by national companies (20%). Only 6.7% were local companies. Regarding the adoption stage, out of 30 organisations, only six (20%) respondents were at organisations that had already adopted cloud computing, while 24 (80%) were not. In addition, another question was asked only of participants who were working in an organisation that had not adopted cloud services, to identify whether they intended to adopt the cloud in the future. In total, 75 % of participants reported that their organisations intended to adopt cloud services in the future, while 25% said their organisations had no intention.

Table 5-5 Characteristics of organisations taking part in this study.

Variable		Frequency	Percentage
Organisation size	1–9 employees	0	0%
	10–49 employees	2	6.7%
	50–250 employees	6	20%
	More than 250 employees	22	73.3%
Industry	Manufacturing	4	13.3%
	Petrochemical	4	13.3%
	Chemicals	3	10%
	Engineering	7	23.3%
	Energy	1	3.3%
	Financial services	2	6.7%
	IT	4	13.3%
	Retail	2	6.7%
	Other	3	10%
Market scope	International	22	73.3%
	Local	2	6.7%
	National	6	20%
Adoption stage	Yes	6	20%
	No	24	80%
Intend to adopt cloud services in future?	Yes	18	75%
	No	6	25%

5.2.2 The Results of the Model Components

This section provides the results of the closed-ended questions regarding the 17 factors. These factors are grouped under four categories:

- Technological factors: quality of service, security, privacy, trust, relative advantage, compatibility, complexity, and trialability.
- Organisational factors: top management support, organisation size, technology readiness, compliance with regulations, competitive pressure, physical location, external support, and industry.
- Social factor: culture.

The purpose of the questionnaire was to confirm which factors affect an organisation's decision regarding using cloud services. SPSS software was used to analyse the data collected from IT staff working in different private organisations in the eastern province of Saudi Arabia. Appendix D provides information about the frequency and percentages of participants' responses to questions. There are two types of statistical tests, known as parametric tests and non-parametric tests. The difference between parametric tests and non-parametric tests is that most parametric tests rely on the assumption the data is normally distributed, while non-parametric tests do not involve distribution assumptions (Field, 2009). Parametric tests analyse data measured by interval scale and ratio, whereas non-parametric tests analyse ordinal and ranked data. On the whole, the parametric tests are more flexible and powerful than non-parametric tests, and thus, preferred by most researchers. Therefore, the collected data was tested using the parametric test (one-sample t-test) and the test value was defined as 3 on the five-point Likert scale, which ranged from 5 (strongly agree) to 1 (strongly disagree). Table 5-6 illustrates the results of the analysis of the questionnaire. A Bonferroni correction was also used in this study to reduce the possibility of having false positive results. Therefore, in this study a factor (statement) is only statistically significant if the p-value $< (\alpha/n)$ $0.05/28 = 0.0017$. This means that a null hypothesis is only rejected if the p-value is less than 0.0017.

The results in Table 5-6 indicate that the means of all factors are greater than the defined value, which is 3 (except the means of two statements regarding the physical location which are highlighted in the table below). Furthermore, the inferential analysis of the collected data clearly shows that the factors are statistically significant (except the following statements, where the p-value is greater than 0.0017):

- Cloud computing technology is trustworthy: $0.004 > 0.0017$.
- Cloud technology is still complex: $0.257 > 0.0017$.

- If our competitors adopted cloud computing it would encourage us to use cloud services in our organisation: 0.229 > 0.0017.
- Knowing the physical location is not important as long as the cloud provider ensures the security of our data: 0.544 > 0.0017.
- Knowing the physical location is not important as long as the cloud provider ensures the privacy of our data: 0.791 > 0.0017.

Although the results show that the above statements (factors) are not statistically significant, the trust factor is expressed by two statements and the p-value of one of these statements is less than 0.0017. Also, 46.7% of respondents agreed that cloud computing technology is trustworthy. So, this factor will be retained in the proposed model.

Moreover, the result shows that the complexity and competitive pressure factors have no significant impact on organisations' decisions. Consequently, these factors will be excluded from the proposed model. The participants were asked two questions to determine whether the physical location is not important, so long as the cloud provider ensures the security and privacy of organisations' data. However, the results do not indicate any significant impact of these relations.

Table 5-6 The analysis of the questionnaire using a one-sample t-test.

Factors			Statements	Mean	Sig. (2- tailed)
Technological Factors	QoS	Availability	Cloud services should be available to support our IT operations.	4.37	<0.001
		Reliability	The reliability of cloud technology has an impact on our decision to use it.	4.10	<0.001
	Security		Security is an important factor when it comes to cloud computing.	4.80	<0.001
			Security concerns affect our decisions to use cloud services.	4.67	<0.001
	Privacy		Privacy is a critical issue that affects our decision to use cloud services.	4.60	<0.001
	Trust		Cloud computing technology is trustworthy.	3.60	0.004
			Storing our organisation's data under third-party control is a concern of ours.	4.20	<0.001
	Relative Advantage		The use of cloud computing in our organisation will help us to reduce costs.	3.90	<0.001
			Cloud computing services will help us to accomplish tasks quickly.	3.90	<0.001
	Compatibility		The compatibility of cloud technology with our work style has a direct impact on our decisions to use cloud services.	4.03	<0.001
	Complexity		Cloud technology is still complex.	3.23	0.257
	Trialability		It is essential to try cloud computing before using it in our organisation.	4.17	<0.001
Organisational Factors	Top Management Support		Management approval is essential before the cloud can be adopted in our organisation.	4.73	<0.001
	Organisation Size		Organisation size needs to be considered before using cloud technology.	4.47	<0.001
	Technology Readiness		Technical knowledge is essential to adopt cloud computing.	4.53	<0.001
			Having skills to use cloud technology is essential.	4.13	<0.001
			Having strong technical infrastructure (e.g., high bandwidth) would encourage us to use cloud computing.	4.53	<0.001
			Having a high speed of Internet would encourage us to use cloud computing.	4.60	<0.001

Factors		Statements	Mean	Sig. (2- tailed)
Environmental Factors	Compliance With Regulations	Compliance with regulations affects our decision to use cloud services.	4.43	<0.001
	Competitive Pressure	If our competitors adopted cloud computing, it would encourage us to use cloud services in our organisation.	3.23	0.229
	Physical Location	It is important to know where the cloud providers will store our data.	4.70	<0.001
		Storing our data in a cloud that runs in a different country could lead to the issue of compliance with regulations.	3.97	<0.001
		Storing our data in a cloud that runs in a different country has an impact on the privacy of data.	4.13	<0.001
		Knowing the physical location is not important as long as the cloud provider ensures the security of our data.	2.83	0.544
		Knowing the physical location is not important as long as the cloud provider ensures the privacy of our data.	2.93	0.791
	External Support	Support from the cloud providers is essential for using cloud services.	4.70	<0.001
	Industry	Using cloud technology depends on the nature of business in the organisation.	4.07	<0.001
Social	Culture	The cultural aspect is an important factor that should be taken into consideration when we use cloud technology.	3.90	<0.001

5.3 Discussion of the Results

This section discusses the findings from the interviews with IT experts, as well as the results of the questionnaire conducted with IT staff in different organisations in private sector in Saudi Arabia, in order to investigate factors that affect an organisation's decision to adopt cloud services.

5.3.1 Technological Factors

In relation to technology, 75% of participants agreed that the performance of technology needs to be considered before obtaining services and the results of the questionnaire confirm the importance of this factor. The quality of services of cloud technology has an impact on an organisation's decision. This finding is consistent with a previous study which reported that the quality of services has a positive influence on cloud adoption in organisations (Güner and Sneiders, 2014).

Furthermore, the findings of the interviews and questionnaire revel that security is an important factor when considering the cloud, and none of the respondents disagreed with the importance of this factor. However, most organisations participating in this study are concerned about the security and privacy and these were the main reasons behind their decision not to adopt cloud services.

In terms of trust, to the best of the author's knowledge this factor have not yet been studied in previous studies as a main factor when investigating factors that influence an organisation's decision regarding adopting the cloud. Trust in cloud technology depends on trust in the technology itself, and in the cloud provider. The results from the interviews indicate that 75% of the IT experts consider trust to be a very important factors in cloud adoption. 46.7% of respondents trust cloud technology itself but not the provider, as is clear from the results of the questionnaire that 43.3% of the participants are concerned about storing their data under third-party control. This concern is also mentioned by a number of experts in different organisations during the interviews as being one of the reasons behind not adopting cloud computing in their organisations.

Regarding relative advantage, the analysis of interviews indicates that organisations that have already adopted cloud services are aware of the benefits of this technology. Cost reduction and flexibility were the main reasons for their decision to use cloud service (see

Appendix B). However, some organisations justify their decision not to adopt cloud services by saying that the cost will be high or will be similar to the cost of maintaining the data in-house. This finding is consistent with a previous study conducted in relation to SME in India (Lyer et al., 2013). One possible reason behind this issue is that cloud technology is still new in Saudi Arabia and the benefits are not clear to the participants, as well as the cost for using cloud technology is on an annual basis. Another possible explanation is the relationship between organisation size and the level of benefits the organisation receives from using cloud. This relation could be investigated in the future. In contrast, in the results of the survey, 36.7% of respondents strongly agreed that cloud services would reduce costs in their organisations while 33.3% strongly agreed that the use of cloud services in their organisations would help them to accomplish tasks quickly.

In addition, the compatibility of cloud technology with an organisation's needs and values is an important factor and has a significant impact on the cloud adoption, as shown in Table 5-6. This result is consistent with past studies (Yeboah-boateng and Essandoh, 2014; Wang et al., 2010), which have stated that compatibility is an essential element for adoption of new technology.

The factor of complexity is usually negatively associated with the probability of adoption of new technology (Premkumar et al., 1994). In the interviews, it is noticeable that complexity was an important factor. In contrast, the results of the questionnaire did not show that complexity was a significant factor. This finding is in agreement with prior studies (Low et al., 2011; Alshamaila et al., 2013; Borgman et al., 2013), which have found complexity to be an insignificant factor in an organisation's decision to adopt cloud services. This finding does not mean that an organisation feels that cloud technology not complex: as is shown in Table 5-6 and Appendix C the mean value of complexity factor is more than three (natural assessment) and 40% of participants agreed that cloud technology is still complex. However, the inferential analysis of responses shows that this factor is not statistically significant. Another possible explanation for this result is that the nature of the cloud is not complex. The concept of cloud computing is simple which is providing and delivering IT services over the Internet to end users in a simple way anytime and anywhere, as well as based on users' needs. Consequently, this factor will be removed from the proposed model.

Trialability is one of the factors suggested by IT experts but it is also one of the components of the DOI model. The experts think that it is better for an organisation to try cloud

technology before using it. The findings of the questionnaire conducted with IT staff confirm the importance of this factor. This result is in line with a previous study (Yeboah-boateng and Essandoh, 2014), which found that trialability is one of the significant factors regarding cloud adoption in developing economies.

5.3.2 Organisational Factors

The characteristics of an organisation also have a significant impact on their decisions. In this study it is apparent from the interviews and questionnaire that the adoption of cloud requires support from top management. The majority of participants emphasised the importance of top management in the adoption decision. This is a very important factor because the adoption decision of the cloud is not only dependent on the views of IT staff: the IT staff need to convince top management that technology will add value to their organisation. In other words, the decision will come from the top management as well as the decision-makers in the IT department. This finding is in agreement with past research that found that top management support is an essential factor and has a positive impact on cloud adoption (Low et al., 2011; Borgman et al., 2013).

In terms of the organisation's size, the results of the interviews showed this to be an important factor. In addition, most of the participants in the questionnaire strongly agreed that the size of the organisation needs to be taken into account before the cloud is adopted in their organisations. In this study it was observed that large organisations are more willing to adopt cloud services in Saudi Arabia, as shown in Table 5-2. This finding seems to be consistent with Low et al. (2011), who state that large organisations have a higher likelihood of adopting cloud services.

Technology readiness is also an important factor influencing cloud adoption. According to the results from the interviews, there is a deep concern about Internet connectivity and speed, and this was one of the main reasons behind not using cloud computing in most participants' organisations in this study. This is because the existing Internet infrastructure in Saudi Arabia is still at the development stage, unlike the developed countries which have a good Internet infrastructure and a lower cost of Internet services compared to Saudi Arabia. Moreover, the results of the questionnaire indicate that most of the respondents in this study strongly agreed that having strong technical infrastructure (i.e., high bandwidth and high speed) would encourage their organisation to use cloud services. Furthermore, the results

show that knowledge and skills are essential for adopting cloud services. This implies that organisations need to fully understands the underlying technology of cloud computing and whether it will align with the organisation's goals and requirements. In addition, more effort must be made at the manpower level to provide the skills to run this technology. In order to increase adoption of cloud in this country effort must also be made to address Internet connectivity. This finding is in line with prior research (Oliveira and Martins, 2010; Zhu et al., 2006), which has indicated that organisations that have technological readiness are more likely to adopt new technology. However, it is inconsistent with another study (Low et al., 2011), which found that the effect of technological readiness on an organisation's decision to adopt cloud computing wasn't significant.

5.3.3 Environmental Factors

In relation to environment, compliance with regulations is also a very important factor and has a significant impact on an organisation decision to use cloud services, as shown in Table 5-6. Some of the participants in the interviews mentioned that compliance issues are one of the reasons that prevented them from using cloud services. The survey results confirmed this concern: 53.3% of participants strongly agreed that compliance with regulations affects their decision to use cloud services.

In this study competitive pressure and trading partner pressure were not found to be significant factors. This finding is inconsistent with previous studies (Low et al., 2011; Borgman et al., 2013). However, this result is in line with another study (Alshamaila et al., 2013), which also found that the competitive pressure factor wasn't a significant factor for cloud adoption in SME in the northeast of England. One potential reason for this result is that the percentage of diffusion of cloud computing in Saudi Arabian organisations is still low and at an early stage.

In terms of the impact of physical location, the analysis of the interviews shows this to be a very important factor impacting cloud adoption. Some experts mentioned that storing their organisations' data in a cloud that is run in a different country could lead to compliance issues and raise privacy concerns. The result of the survey confirmed these relationships: as shown in Table 5-6, 40% of participants agreed that storing their organisations' data in a cloud that is run in a different country has an impact on the compliance with regulations. In addition, 46.7% of respondents agreed that storing their organisations' data in a cloud that is

run in a different country has an impact on privacy. Some of the interviewees stated that knowing the physical location is unimportant as long the cloud provider ensures the security and privacy of an organisation's data. In contrast, the results of the questionnaire show that it is important to know where the cloud provider will store their data: about 73.3% of participants strongly agreed on this point, as shown in Table 5-6. This implies that organisations in Saudi Arabia might prefer to store their data inside the country.

Moreover, the findings from the interviews make it clear that there is a need for external support from cloud providers to meet an organisation's needs. The result of the questionnaire emphasised the importance of this factor in an organisation's decision: as shown in Appendix C, 73.3% of respondents strongly agreed that support from a cloud provider is essential for using cloud services. This finding is consistent with a former studies (DeLone, 1981; Scupola, 2003), which stated that the availability of external support has a significant impact on adoption of new technology.

In terms of industry, this factor emerged from interviews and the results indicate that the nature of the business needs to be considered before the cloud can be adopted. 46.7% of participants agreed that the use of cloud services depends on the nature of the business of their organisation. This result is in line with previous studies that have stated that the sector of the business to which a firm belongs has an effect on the decision whether or not to adopt new technology (Yap, 1990; Goode and Stevens, 2000).

5.3.4 Social Factor

Finally, this study also shows that culture has an impact on the adoption decision. The results of the questionnaire emphasised the importance of the culture factor as 46.7% of participants agreed that the cultural aspect is an important factor and should be taken into consideration when it comes to cloud technology. In fact, several studies have found that culture is one of the factors that influence the use of online services and the adoption of new technology (Straub, et al., 2003; Weerakkody, 2008; Walsham et al. 1988).

Furthermore, the findings show that there is a positive attitude towards adopting cloud services in private sector in Saudi Arabia: as shown in Table 5-5, 75 % of participants stated that their organisations intend to adopt cloud services in the future.

After considering the findings of the study, the cloud adoption model was developed, as illustrated in Figure 5-1.

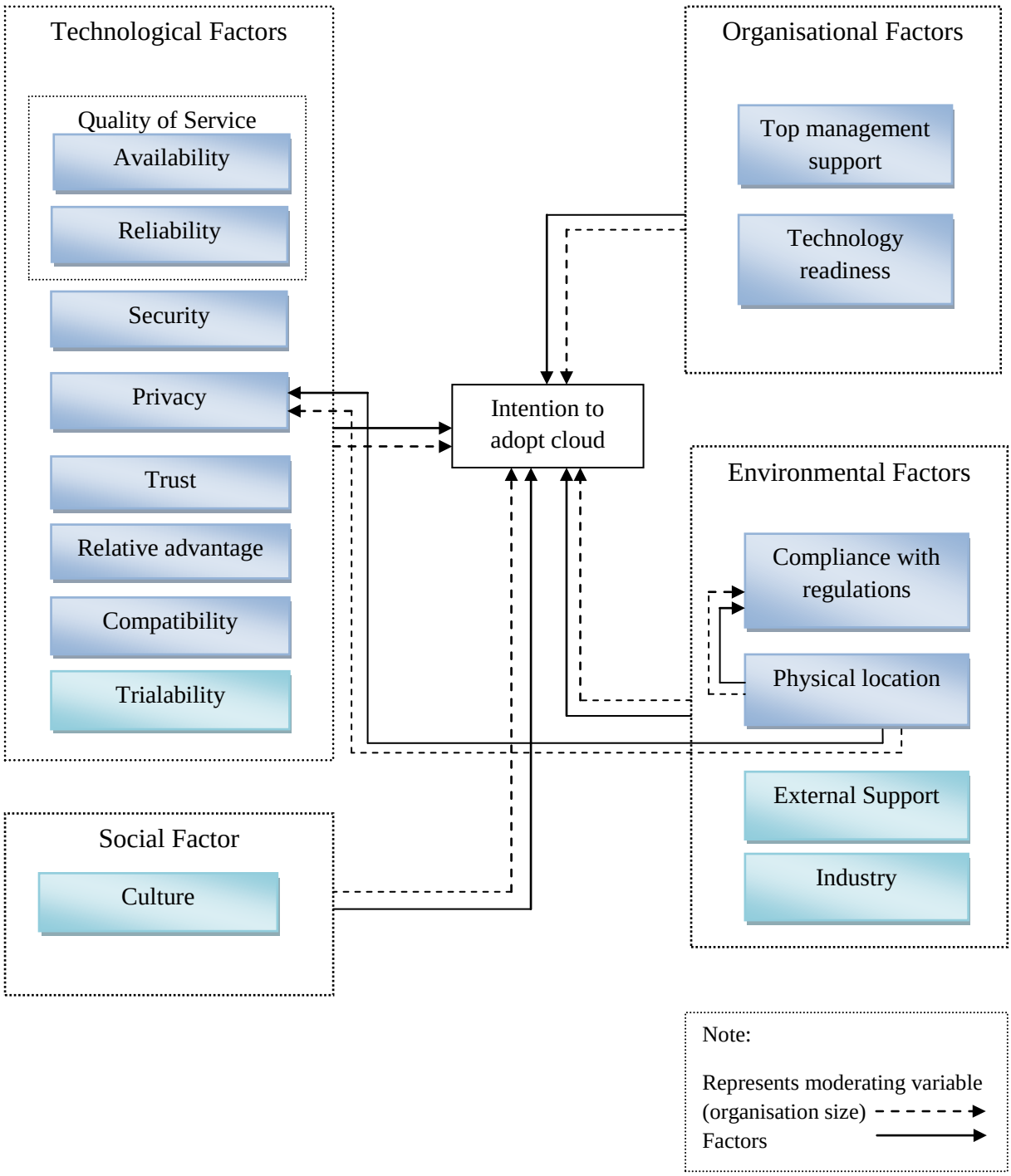

Figure 5-1 Cloud computing adoption model for private organisation in Saudi Arabia.

5.4 Summary

This chapter has presented the results of the interviews and questionnaires. Semi-structured interviews were used to review the factors identified previously in Chapter 3 and to explore other factors that were not mentioned in previous studies. The findings from the interviews showed that all the proposed factors in Chapter 3 were statistically significant importance, except two factors, which are competitive pressure and trading partner pressure. In addition, the analysis of the interviews indicated that there are other factors that influence an organisation's intention to use cloud services in Saudi Arabia. These factors are trialability, external support, industry, and culture. The results of the questionnaire confirmed the impact of these factors. However, the results of the questionnaire which were conducted with IT professionals in order to confirm what factors affect an organisation's intention to use cloud services did not indicate that complexity and competitive pressure have a significant impact on the adoption decision. Consequently, these factors have been removed from the model. Finally, this chapter ended with a discussion of the findings from the interviews and questionnaire. The results of this study were used to improve the proposed model.

Chapter 6: Research Methodology for Evaluation Study

After confirming the factors in the cloud adoption model in the previous chapters, this chapter offers an overview of the research methods utilised in the second stage of this research for testing the proposed model and research hypothesis. It starts with a brief discussion of the research approach that best suits this research. It discusses the research strategy utilised in this study and presents the process of designing and developing the questionnaire. This chapter also explains the selection of sample size and the tests used for ensuring the reliability and validity of this study. Finally, it presents the data analysis procedures.

6.1 Research Approach

Choice of research approach is an important step in the research design (Creswell, 2013). There are two types of research approach: deductive and inductive (Saunders et al., 2009). The philosophical assumptions also have an impact on selection of the research approach (Saunders et al., 2009). The deductive approach is usually adopted in scientific research that used a positivist position, whereas the other approach, which is inductive, is usually in line with the interpretivist paradigm. The selection between these two approaches depends on whether the research is built based on existing theory or theories are built on the results of the research (Gray, 2009; Collis and Hussey, 2009). In the deductive approach the researcher reviews the literature to identify theories and ideas regarding the research. Based on this foundation, the theoretical framework is proposed and hypotheses are generated and then tested using the collected data. The outcomes can be generalised to a wider context. However, in the inductive approach the data is collected firstly and then the theory is built as outcomes of the data analysis (Saunders et al., 2009).

This research takes a scientific theme and adopts a positivist philosophy; therefore, the deductive approach is considered to be most appropriate for the present study. Thus, the study reviewed the existing literature on technology adoption and cloud computing to propose a theoretical model, through the process described in Chapter 2, and to identify factors that influence cloud adoption. After proposing a theoretical model for cloud adoption, data was collected to elicit the factors that encourage or impede cloud adoption in the private sector in Saudi Arabia. The deductive approach was considered as most suitable approach

for this study, which seeks in-depth investigation of relationships between variables and tests the hypothesised relationships.

6.2 Research strategy

There are a variety of strategies used by researchers in the domain of information technology and social sciences, for instance, case study, experiment, survey and grounded theory. However, some of these methods are suitable with a quantitative approach, while others are related to a qualitative approach (Myers, 1997; Crotty, 1998). In any research, the choice of an appropriate strategy is not an easy task. The researcher should select the strategy that suits the research questions (Saunders et al., 2009). Moreover, the availability of resources and prior knowledge has an impact on the selection of a research strategy. According to Rea and Parker (2014), the questionnaire is an appropriate strategy when the research requires a large sample size in order to test hypotheses. Most researchers in the information systems field consider this strategy as suitable for testing hypotheses (Chen and Hirschheim, 2004). Furthermore, the survey is reported as one of widely-used strategies in studies of technology adoption and usage at organisational level and individual level (Choudrie and Dwivedi, 2005). The survey helps researchers to measure opinions of participants and their decisions about the phenomenon (Zikmund, 2003; Mack et al., 2005). Therefore, the questionnaire was selected as the most suitable strategy for this study.

6.3 Research Design

Research design is the way of organising research activity to fulfil its aims (Easterby-Smith et al., 2002). In other words, it refers to the plans or strategies for data collection in order to answer the research questions (Kerlinger, 1986). The research design can help researchers to collect the necessary data that can be used to answer the research questions (Sekaran and Bougie, 2010).Thus, the researcher needs to consider that the chosen design fits with the research questions that need to be answered.

The research purposes are classified into three types: exploratory, explanatory and descriptive (Cooper and Schindler, 2003; Saunders et al., 2009). A study is called exploratory when it seeks to explore and understand the problem under investigation and provide new insights into a phenomenon (Robson, 2002), while an explanatory study is

seeking to explain relationships among variables that exist within a phenomenon (Saunders et al., 2009). In other words, it seeks to explain the causes of the phenomenon under investigation. This research was undertaken using two approaches, both exploratory and explanatory research design. The exploratory research approach was adopted in the first stage of this study and presented in previous chapters, which involved reviewing existing literature and former studies and collecting qualitative and quantitative data. The exploratory stage helped to clarify problems regarding cloud adoption and assisted in developing the research model of this study, with associated factors. It also, helped in constructing the research hypotheses.

In the second stage, an explanatory research approach was employed in order to examine relationships among factors. According to Saunders et al. (2009), studies that seek to evaluate relationships among variables are considered as explanatory. However, Jackson (1994) emphasises that 'descriptive' is the nature of all research and Saunders et al. (2009) also point out that the descriptive element of research could be the basis for both exploratory and explanatory research. In this evaluative stage, the data was collected through questionnaires and used to evaluate the cloud adoption model (Figure 5-1) and to test the hypothesised relationships.

This research utilised a questionnaire strategy in order to evaluate the proposed model for cloud adoption that was confirmed previously in Chapter 5, and to answer the remaining questions of this research:

Q2. What is the relationships between the factors and an organisation's intention to adopt cloud services?

Q3. Does the size of an organisation moderate the relationships between the factors and an organisation's intention to adopt cloud services?

Q4. What is the difference between adopter and non-adopter companies in terms of the effect of these factors?

The questionnaire technique was considered as a suitable method for in-depth investigation of relationships between variables and to examine the following hypotheses:

H1: Quality of services will positively affect an organisation's intention to adopt cloud computing.
H1a: Organisation size will moderate the relationship between quality of services and an organisation's intention to adopt cloud computing.

H2: Security concerns will negatively affect an organisation's intention to adopt cloud computing.
H2a: Organisation size will moderate the relationship between security concerns and an organisation's intention to adopt cloud computing.

H3: Privacy concerns will negatively affect an organisation's intention to adopt cloud computing.
H3a: Organisation size will moderate the relationship between privacy concerns and an organisation's intention to adopt cloud computing.

H4: Trust will positively affect an organisation's intention to adopt cloud computing.
H4a: Organisation size will moderate the relationship between trust and an organisation's intention to adopt cloud computing.

H5: Relative advantage will positively affect an organisation's intention to adopt cloud computing.
H5a: Organisation size will moderate the relationship between relative advantage and an organisation's intention to adopt cloud computing.

H6: Compatibility will positively affect an organisation's intention to adopt cloud computing.
H6a: Organisation size will moderate the relationship between compatibility and an organisation's intention to adopt cloud computing.

H7: Trialability will positively affect an organisation's intention to adopt cloud computing.
H7a: Organisation size will moderate the relationship between trialability and an organisation's intention to adopt cloud computing.

H8: Top management support will positively affect an organisation's intention to adopt cloud computing.
H8a: Organisation size will moderate the relationship between top management support and an organisation's intention to adopt cloud computing.

H9: Technology readiness will positively affect an organisation's intention to adopt cloud computing.
H9a: Organisation size will moderate the relationship between technology readiness and an organisation's intention to adopt cloud computing.

H10: Compliance with regulations will positively affect an organisation's intention to adopt cloud computing.
H10a: Organisation size will moderate the relationship between compliance with regulations and an organisation's intention to adopt cloud computing.

H11: Physical location will positively affect an organisation's intention to adopt cloud computing.
H11a: Organisation size will moderate the relationship between physical location and an organisation's intention to adopt cloud computing.

H11.1: Physical location has direct impact on compliance with regulations.
H11.1a: Organisation size will moderate relationship between physical location and compliance with regulations.

H11.2: Physical location has a direct impact on privacy.
H11.2a: Organisation size will moderate relationship between physical location and privacy.

H12: External support will positively affect an organisation's intention to adopt cloud computing.
H12a: Organization size will moderate the relationship between external support and an organisation's intention to adopt cloud computing.

H13: The industry to which a firm belongs will have an impact on an organisation's intention to adopt cloud computing.

H13a: Organisation size will moderate the relationship between industry and organisation's intention to adopt cloud computing.

H14: Culture will positively affect an organisation's intention to adopt cloud computing.
H14a: Organisation size will moderate the relationship between culture and an organisation's intention to adopt cloud computing.

6.4 Questionnaire Design

The questionnaire was designed to evaluate the cloud adoption model (Figure 5-1) and to answer the remaining questions of this research, as well as to assess the proposed hypotheses regarding relationships. The survey started with a cover letter which included a welcome statement, and provided brief explanation of the purpose of this study as well consent information. The survey was divided into three sections, which comprised:

Part I: Company Details:
This part included questions related to demographic and institutional information such as organisation size, industry, market scope and adoption stage. This section was important to provide useful information for comparison purposes between companies.

Part II: To what extent do you agree with the following statements?
This second part of the questionnaire included closed-ended questions about an organisation’s intention to adopt the cloud and the technological factors involved, which were quality of service, security, privacy, trust, relative advantage, compatibility, and trialability.

Part III: To what extent do you agree with the following statements?
The final part of the questionnaire also measured the relationships between factors and an organisation’s decision. This part included closed-ended questions about organisational factors, environmental, and social factors.

Overall, the 14 factors in the research model along with intention to adopt the cloud were measured using 64 closed-ended questions. These statements were adapted from former

studies and some items were been modified to fit with this study and the Saudi Arabian context. Table 6-1 illustrates the numbers of items used to measure variables in this study and the source. In this research, the closed-ended questions were designed using a five-point Likert scale: (strongly agree = 5; agree = 4; neutral =3; disagree =2 and strongly disagree = 1). The questionnaire questions were designed in English and were also translated into Arabic. The questionnaire was examined by six researchers at the University of Southampton and one researcher at Kings College London, in order to confirm clarity of questions and to resolve any possible problems before being distributed to participants. Out of the seven participants, four were speakers of both Arabic and the English language, in order to validate and ensure the accuracy of the translated questions. This test was useful in improving the content of the questionnaire and in enhancing the validity. According to Saunders et al., (2009), testing the questions by a small group before it is distributed widely can enhance content validity.

The final version of the questionnaire was administered in both Arabic and English and was distributed both electronically and on paper. In this study, the iSurvey tool offered by the University of Southampton and available at https://www.isurvey.soton.ac.uk/ was used to develop the online questionnaire. The link to the questionnaire was distributed via email to IT staff working in different organisations in the private sector in Saudi Arabia. The data was also collected from IT staff through the traditional method on paper, in order to increase response rate. The English and Arabic versions of the questionnaire are provided in Appendix E.

Table 6-1 Measurement items of research variables.

Construct	**Items**	**Adapted source**
Technological Factors		
Quality of Service	6 items	Rehman et al., 2012
Security	4 items	Zhu et al., 2006; Luo et al., 2010; Wu, 2011
Privacy	4 items	Featherman and Pavlou, 2003
Trust	4 items	Added by the researcher
Relative Advantage	4 items	Moore and Benbasat, 1991; Ghobakhloo et al., 2011
Compatibility	4 items	Moore and Benbasat, 1991; Premkumar and Roberts, 1999

Construct	Items	Adapted source
Trialability	4 items	Moore and Benbasat, 1991
Organisational Factors		
Top Management Support	4 items	Yap et al., 1994
Organisation size	1 item - number of employees in the company	Premkumar and Roberts, 1999
Technology Readiness	6 items	Oliveira and Martins, 2010; Ifinedo, 2011
Environmental Factors		
Compliance with Regulations	4 items	Zhu and Kraemer, 2005; Alam et al., 2011
Physical Location	4 items	Added by the researcher
External Support	5 items	Yap et al., 1994; Premkumar and Roberts, 1999
Industry	3 items	Goode and Stevens, 2000
Social factor		
Culture	4 items	Added by the researcher
Intention to Adopt Cloud	4 items	Premkumar and Roberts, 1999; Yoon, 2009

6.5 The Sample Size

As collecting data from the entire population it is impracticable, selecting the sample size of the study is essential. There are two sampling techniques: probability sampling techniques and non-probability sampling techniques (Cohen et al., 2011). Probability sampling is a common technique that uses a random selection method (Cohen et al., 2011). Simple random sampling and stratified random sampling are examples of probability sampling (Sekaran and Bougie, 2013). Non- probability sampling does not require random selection, the selection of the sample is based on the decision of the researcher (Henry, 1990). Examples of non-probability sampling include accidental, also called convenience sampling and snowball sampling (Babbie, 2013).

The availability of the resources has significant impact on the sampling technique utilised in the research (Saunders et al., 2009). The accidental sampling technique was used in this study, which is a non-probability sampling. In this technique, the participants' responded to

questionnaire according to their availability and willingness (Gravetter and Forzano 2012). Selecting sample using this technique was quicker and easier to manage in the time compared to the other techniques that required more technical resources and time such as probability sampling techniques.

This research investigated the factors that influence an organisation's decision to adopt cloud computing in the private sector in Saudi Arabia. Consequently, the target respondents of this study were IT staff in the private sector in Saudi Arabia; this was due to their ability to understand the current situation of their organisation and new information technology. Moreover, they are also involved in the decision making process, whereas top management are often difficult to reach.

In order to ensure the reliability of the results and to generalise the results obtained from the data collected, an adequate sample size is needed. According to Saunders et al. (2009), when using a large sample size, the error rate in generalising the results will be lower. The choice of sample size is also affected by the type of test that will be performed for data analysis (Saunders et al., 2009).

In this study the data will be analysed using Structural Equation Modelling (SEM). Kline (2011) suggests that if the study uses SEM, the typical sample size should be about 200. It has been suggested the minimum sample size per variable could be 5 participants, 10 responses or 15 responses per variable (Bentler and Chou, 1987; Hair et al., 1992; Stevens, 2002), while Stevens (2002) also suggests that 20 participants per factor is required, if SEM is used. However, there is no agreement among the researchers about the optimum number for the size of sample (Raykov and Marcoulides, 2006; Sivo et al., 2006), so, there is no fixed number for sample size. However, as it is agreed that 200 cases and above can be considered adequate for performing a reliable and robust analysis like SEM (Anderson and Gerbing, 1988; Hair et al., 2010; Kline, 2011). Therefore, it was decided that the minimum sample size in this study would be 200 participants. The number of participants used in this study was 300 IT staff working in the private sector in Saudi Arabia.

6.6 Missing Data

Missing data is one of problems that happens in any study that utilises a survey as a tool for collecting data (Acuna and Rodriguez, 2004). Before starting any statistical analysis, it is necessary to ensure the collected data are error free. Kline (2011) states that the analysis of data through SEM may fail to obtain accurate results and that it would be difficult to obtain a model fit if there are any missing values in the collected data, due to the fact that SEM analysis is based on the assumption that the data is free of error. Therefore, any missing data in the collected data must be resolved before conducting the analysis. There two ways of resolving the missing data issues: either by replacing missing values with estimated new values or by deleting any cases that contain missing values (King et al., 1998). However, these methods should be carefully applied, because the sample size can be affected when excluding a large number of responses and this can also affect the statistical power of the outcomes (King et al., 1998). Moreover, applying the other solution, which is substituting missing data with new values, may lead to bias (Graham et al. 2007). However, the rate of missing data is manageable if it is in the range 1-5%, and the missing values can be changed with the mean value (Acuna and Rodriguez, 2004; Schumacker and Lomax, 2004; Hair et al., 2010). It is unacceptable if above 5% and can lead to misinterpretation (Acuna and Rodriguez, 2004).Therefore, if there are any cases that include missing data above 5%, these will be excluded from the analysis in this study. Although the questionnaire was designed and administered carefully, this cannot prevented the missing data problem entirely. The number of responses excluded in this study are reported in detail in the next chapter.

6.7 Goodness of Instrument

It was necessary to ensure the validity of the instrument before and after data collection. The reliability of the instrument also needed to be evaluated in order to increase the precision of this study. After designing the questionnaire, it was important to ensure that the questions were accurately measuring the factors that it was supposed to measure. Therefore, validity and reliability tests needed to be conducted in order to obtain accurate and reliable results from the questionnaire (Sekaran, 2003). In this study, the validity was considered before and after the data collection, and reliability was assessed after data collection. The validity and reliability of the instrument will be explained in detail in the following sections.

6.7.1 The Validity of the Instrument

The validity of the instrument is necessary in order to ensure that the statements of the questionnaire measure the variables that they are supposed to measure accurately (Pallant, 2011). The validity ensures that the collected data and findings represent the current situation truly. The instrument used in this research was assessed using two validation tests, which are content and construct validity.

6.7.1.1 Content Validity

The content validity is the first step that needs to be considered after designing the questionnaire and before collecting the data. Content validity is *"a judgment of how appropriate items seem to a set of reviewers who have some knowledge of the subject matter"* (Litwin, 2003). A review of the instrument is conducted in order to ensure that the instrument involves all the appropriate items for measuring each construct. However, the construct validity cannot be established without considering the content validity (Garver and Mentzer, 1999).

The content validity can be accomplished through a literature review and expert advice (Straub et al., 2004). The present study utilised these two strategies in order to verify the content validity of the instrument. Straub et al. (2004) suggest that using items validated previously in the literature, when they are available, is better than developing new questions. Consequently, in this study, the statements of the questionnaire that were used to measure the factors in the cloud adoption model were adapted from existing studies, as shown in Table 6-1. However, some items were modified to fit the research context and other items were added by the researcher. These questions related to technological factors (trust), environmental factors (physical location) and social factors (culture) that were not included in former studies within the cloud context.

Therefore, further assessment of the instrument was needed. Seven experts who had experience in questionnaire design were asked to review the instrument of this study. Lynn (1986) suggests that five is the minimum number of experts; however, the number may depend on their availability. The experts who participated in this study were researchers at UK universities and four of them were speakers of both Arabic and English, in order to validate the translated version of questionnaire. Thus, in order to ensure content validity, the

researchers were asked individually to provide feedback and suggestions on the instrument. Through their review a few typographical errors were rectified and changes were made to some unclear questions and statements. Overall, there were about twenty-three questions that were reformulated.

6.7.1.2 Construct Validity

In order to increase the precision of the research, the construct validity needs to be assessed. The construct validity is defined as *"to what extent measurement items are reflecting the construct they were designed to measure"* (Hair et al., 2010). In other words, it assesses to what extent the statements of the questionnaire represent the factors which it is supposed to measure. Assessing the validity of the construct is an essential step in SEM. The construct validity must be evaluated through various methods in order to avoid random error and method variance (Bagozzi and Yi, 1991). Therefore, in this study the construct validity was evaluated after collecting the data, through three methods, which are convergent validity, discriminant validity and nomological validity (Straub and Gefen, 2004; Hair et al., 2010). These three validation tests will be explained in detail and the results will be presented in the following chapter.

6.7.2 The Reliability of the Instrument

Reliability analysis is an important technique to ensure the accuracy and goodness of an instrument (Sekaran and Bougie, 2010). The reliability test needs to be conducted, especially when there are multiple items for each construct, to ensure internal consistency of these items (Bryman and Cramer, 2011). The reliability also needs to be tested when Likert scales are utilised in the questionnaire (Eagly and Chaiken, 1993). There are two ways of establishing reliability which are widely used: internal consistency and test-retest reliability (Pallant, 2013). Internal consistency refers to the degree to which the items are internally consistent in their measurements (Pallant, 2013). In test-retest reliability the results of the test should be consistent over time. Thus, the reliability in this test can be assessed by performing same test with the same group but on different occasions and then the correlation between the two results is the degree of reliability (Pallant, 2013).

In this study, the internal consistency test was utilised to assess reliability. Cronbach's alpha is one of most popular methods used to measure internal consistency (Cronbach, 1951; Sekaran, 2003; Stangor, 2011). Cronbach's alpha is a statistical procedure that has been used in this study to assess the reliability of the instrument in the preliminary analysis of the data using SPSS software. Cronbach's alpha examines how well, the internal consistency, of a set of items measures a single construct (Tabachnick and Fidell, 2013). The results provide the average correlation among items of the same construct (Pallant, 2013). The Cronbach's alpha value is range from 0 to 1. The higher values indicate greater internal consistency and thus, reliability (Pallant, 2013; Takona, 2002). In general, the value of Cronbach's alpha is considered very good if it is 0.8 or above; from 0.6 to 0.7 is acceptable and it is seen as low and unacceptable if less than 0.6 (Robinson et al., 1991; Sekaran, 2003; Field, 2009). However, the value of Cronbach's alpha is affected by the number of items utilised for measuring each factor (Cortina, 1993).

In this study, the reliability was evaluated using Cronbach's alpha after collecting data and the results are presented in the data analysis chapter (Chapter 7). Furthermore, this research tested reliability in the SEM analysis stage. Composite reliability, which is also known as construct reliability, was calculated in order to measure the reliability of the construct, which is an essential step in SEM. The composite reliability also explained in detail in the next chapter.

6.8 Data Analysis Procedure

The aim of conducting statistical analysis was to evaluate the proposed model for cloud adoption. This section explains the procedures used for analysing data.

6.8.1 Preliminary Analysis of the Data

After collecting the data and before conducting any statistical analysis, it is first important to ensure the data is free of errors. The examination of data is essential to obtain accurate results and also the software used for powerful analyses in SEM is based on the assumption that the imported data is free of any error (Kline, 2011). Therefore, at this stage the collected data were examined to see if there were any missing data, using SPSS software. The missing data issues were resolved at this stage. The SPSS software was then used for analysing

demographic and institutional information, such as industry, market scope. The reliability of the instrument in this study was also assessed at this stage, using Cronbach's alpha with SPSS software. The results and more details of these analyses will be presented in the next chapter. The next step was testing proposed model and research hypothesis through SEM. The following section explains the SEM approach in detail.

6.8.2 Structural Equation Modelling (SEM)

SEM is a statistical analysis technique which is used to test interrelationships among multiple variables (Hoyle, 1995; Pallant, 2010). In this study, the main reasons for collecting data were to evaluate the proposed model (Figure 5-1) and to test the hypothesised relationships. These are among the key features of the SEM technique, which compares the collected data with theoretical model (Byrne, 2010). Thus, the SEM approach can bring the data and theory together (Tabachnick and Fidell, 2013). Hence, the SEM approach was seen as the most appropriate approach for testing the proposed model and hypotheses in the present study.

Theoretically, the factors in the proposed model cannot be measured directly. The term latent variables or construct variables is used in SEM to refer to all factors in the proposed model that cannot be measured directly; these are also known as unobserved variables. However, these variables can be measured indirectly using multiple measured variables, also known as observed variables and indicator variables (Schumacker and Lomax, 2010). For example, in this study the intention to adopt the cloud and all the factors in the proposed model were represented as latent variables, while the term indicator variables refers to items used to measure these factors (latent variables). SEM is a statistical method that analyses the relationships between unobserved variables and their observed variables in path diagrams (Hoyle, 1995; Hair et al., 2010). One of the benefits of utilising SEM is to analyse and study the relationships between the latent variables measured by multiple observed variables (Choudrie et al., 2013).

There are several advantages that distinguish SEM techniques from other statistical techniques. In this study the SEM technique was used for testing the proposed model for several reasons. The SEM has the ability to analyse a series of relationships simultaneously, while other statistical methods, such as multiple regression, or multivariate analysis of

variance, are limited to analysing the relationships between each variable singly (Byrne 2010; Schumacker and Lomax, 2010). Therefore, SEM has the capability to analyse a complex theoretical model that involves multiple variables, and can analyse direct and indirect relationships between variables simultaneously (Byrne, 2010). The SEM technique includes multiple regression analysis and factor analysis, which help to assess how well the proposed model fits with the collected data (Byrne, 2010; Hair et al., 2010). SEM is considered a confirmatory approach, while the nature of most other multivariate approaches is descriptive and it is difficult to test a theoretical model through them (Byrne, 2010). Moreover, the SEM technique takes into account whether the relationship between variables is free of error, which means it considers the measurement error in the indicator variables (Raykov and Marcoulides, 2006). The SEM approach has the ability to analyse data with multiple groups, such as organisation size (Schumacker and Lomax, 2010).

The proposed model was analysed using two levels of analysis in SEM, the measurement model and the structural model. The measurement model is an essential step in SEM and without it the results of the analysis will be misleading (Kline 2011). In the measurement level, the relationships between latent variables and their indicators were examined (Suhr 2006; Hair et al., 2010). In other words, the relationships between factors in the proposed model and items used to measure these factors were assessed at this stage. Furthermore, in the measurement level, the evaluation of construct validity and construct reliability is completed, in order to ensure the instrument is accurately measuring what it is supposed to measure (Hair et al., 2010).

In the structural model, the relationships among the latent variables were examined (Hair et al., 2010). Thus, the analysis focused on the relationships among construct variables rather than relationships between construct variables and their observed variables (indicators). In this stage, the model fit was assessed and the relationships among construct variables were examined. Hence, the hypothesised relationships were tested at this stage. There are several software packages that can be used for SEM analysis, such as AMOS, EQS, Mplus and LISREL. In this research, the Analysis Moment of Structures (AMOS) software was utilised for analysing data through SEM; this was due to the availability of this software (Byrne, 2010). The measurement model and structural model will be explained in detail, together with the results, which will be presented in the following chapter.

6.9 Ethical Approval

As the research was conducted with IT staff in the private sector in Saudi Arabia, ethical issues were taken into consideration before collecting data. Therefore, before distributing the survey to participants, an ethical approval form was submitted to the Ethics committee at the University of Southampton. The privacy and confidentiality of data collected from participants were considered and participants consent was ensured. The ethical form of this study was reviewed and approved by the Ethics committee and the reference number was 16991.

6.10 Summary

This chapters began with a brief discussion of the research approach. This research adopted a positivist philosophical position, as the study has a scientific theme. This paradigm also supports objective views about reality. A deductive approach was taken in this research, which is in line with the positivist philosophy.

This chapter has presented in detail the methods used in this study for evaluating the proposed model. The questionnaire strategy was considered an appropriate method for this stage, in order to test the proposed model and the research hypotheses. The appropriate sample size was considered to be more than 200 cases. This chapter also explained in detail the process of designing and developing the questionnaire. The survey was designed in English and was also translated into Arabic. The validity and reliability of the instrument is essential in order to obtain accurate results. Thus, the tests utilised for verifying the validity and reliability of this study have been discussed in this chapter. Content validity and construct validity were verified to validate this study. The content validity was considered before collecting data in order to ensure the questions used in this study accurately measured what they were supposed to measure, while the construct validity was assessed after collecting the data. In this study, after collecting data a reliability analysis was conducted using Cronbach's alpha and the composite reliability was assessed through SEM. The procedures used for analysing data were also discussed in this chapter. The SEM approach was considered as an appropriate technique for evaluation of the proposed model and testing the research hypotheses. SEM has the capability to analyse a complex model that involves multiple variables and analyse relationships among multiple variables simultaneously.

Ethical issues were also considered in this study before distributing the questionnaire. The next chapter will present the details of the data analysis and the results of the survey.

Chapter 7: Data Analysis and Results

This chapter presents the results of the questionnaire which was used to test the proposed model. The first section in this chapter present the results of the preliminary analysis of the data which includes some missing data and demographic and institutional information. The reliability of the instrument used in this study is also discussed in detail before assessing proposed model through SEM. The chapter also provides the results of evaluating the proposed model through two stages in SEM (measurement model assessment and structural model assessment). Finally, this chapter discusses the results of assessment of the proposed hypotheses. In this study two tools were used for analysing the collected data, SPSS software and AMOS.

7.1 Preliminary Analysis of the Data

This section presents the results of the preliminary analysis of the data in the questionnaire. SPSS software was used for this initial analysis. The results are divided into three sections. To ensure accuracy of the data and to avoid problems in analysis, the collected data was examined to check if it included missing values. Hence, the first section presents the analysis of the collected data regarding the missing values and the second section provides the results relating to demographic and institutional information. The third section presents the preliminary assessment of the instrument reliability.

7.1.1 Missing Data

Missing data is one of issues that occurs in any study using questionnaires (Acuna and Rodriguez, 2004). As mentioned earlier in Chapter 6, the questionnaire was distributed both electronically and on paper. The number of employees who accessed the questionnaire link was more than 300 people, of which only 131 participants completed the online version. Although all the questions were mandatory, there were twenty participants whose answers to the questionnaires were incomplete. Out of these twenty cases only nine responses were excluded from the analysis as having missing values above the acceptable rate (5%), while in the remaining cases, for which missing values were less than 5%, they were replaced with the mean value of the same question, as this was considered acceptable and would not lead to misinterpretation (Acuna and Rodriguez, 2004; Schumacker and Lomax, 2004; Hair et al.,

2010). The number of participants who returned questionnaires in the paper-based version was 181. However, there were three cases who returned the survey with most items unanswered; these were deleted from the data analysis. In this study the total number of respondents for both versions (online and paper-based) was 312. Thus, after excluding the incomplete data that exceeded the accepted rate (9 cases from the online version and 3 cases from the paper-based version), 300 responses were used in the analysis.

7.1.2 Demographic and Institutional Information

The first part of the questionnaire collected demographic and institutional information. The survey was conducted in different non-governmental organisations in Saudi Arabia from July 2015 to January 2016. In this study all the participants were working in IT departments and had at least two years working experience. The largest group of respondents, 43.3%, were those with more than ten years working experience in the information technology field followed by 33% of participants who had experience of between six and ten years.

In order to determine the characteristics of the organisations participating in this study, the respondents were asked to specify the following attributes of their organisations: the organisation's size, age, annual revenue, business nature, market scope and stage of adoption of cloud technology. The results of the demographic and institutional information are presented in Table 7-1. The size of the organisation was identified based on the number of employees. Among the participating companies, only 18% were small enterprises, whereas the largest group of participating companies comprised large enterprises, representing 49.3% of the sample, followed by medium-sized enterprises (27%).

In terms of the age of the company, the results showed that almost half (47.7%) of the participants were working in a company that had been established for more than twenty years. Only 9.7% of the companies had been established for between one to five years. Almost half of the respondents in this study (48.3%) worked in an organisation for which the annual revenue was more than US$ 20 million, which was expected, as most of participants were working in large enterprises. In this study the respondents were working in a variety of manufacturing and service industries, as shown in Table 7-1. It is clear that the data were distributed quite evenly with a range of about 10 to 12% in most of the sectors; however, it was relatively fewer in the other sectors such as energies and financial services. Regarding

market scope, 44% of the participants in the sample were working in international organisations and 40% in local organisations, while only 16% were working in national companies.

A further question was asked to participants to identify whether their organisations had adopted cloud services. The results showed that the majority of the participants' companies had not adopted cloud computing technology (78%), while only 22% of the respondents reported that their organisation already used cloud computing. Private cloud was the most popular type used in participants' companies, reported by 60.6% of respondents, followed by public cloud with 24.2%, while only 15.2% of participant companies were using hybrid cloud. Table 7-1, also presents the frequencies and percentages of organisations who had already adopted cloud technology and non-adopters. It is notable that 75.8% of organisations who utilised cloud technology were large enterprises and had been long established (more than twenty years). Moreover, 74.2% of these organisations had an annual revenue of more than US$ 20 million. It is interesting to note that most of the participants' companies which had already adopted cloud computing were from the technology sector, whereas non-adopters were from the manufacturing and petrochemical sectors. Furthermore, it was found that a higher proportion of organisations with a wide market scope had adopted cloud technology, compared to organisations with only local scope, as the percentage of international organisations which were already using cloud technology was 68.2%.

Table 7-1 Characteristics of participants and organisations in this study.

Variable	Frequency	Percentage	Adopter	Percentage	Non-Adopter	Percentage
Work experience in IT field:						
2-5 years	71	23.7%	14	21.2%	57	24.4%
6-10 years	99	33.0%	20	30.3%	79	33.8%
More than 10 years	130	43.3%	32	48.5%	98	41.9%
Organisation size:						
1–9 employees	17	5.7%	3	4.5%	14	6.0%
10–49 employees	54	18.0%	8	12.1%	46	19.7%
50–250 employees	81	27.0%	5	7.6%	76	32.5%
More than 250 employees	148	49.3%	50	75.8%	98	41.9%
Company age:						
Less than a year	2	0.7%	1	1.5%	1	0.4%
1-5 Years	29	9.7%	6	9.1%	23	9.8%
6-10 Years	54	18.0%	7	10.6%	47	20.1%
11-20 Years	72	24.0%	7	10.6%	65	27.8%
More than 20 years	143	47.7%	45	68.2%	98	41.9%
Annual revenue (US **$):**						
Less than 1 million	33	11.0%	4	6.1%	29	12.4%
1-5 million	40	13.3%	3	4.5%	37	15.8%
6-20 million	82	27.3%	10	15.2%	72	30.8%
More than 20 million	145	48.3%	49	74.2%	96	41.0%
Business nature:						
Chemicals	35	11.7%	11	16.7%	24	10.3%
Energy/Utilities	10	3.3%	3	4.5%	7	3.0%
Engineering	37	12.3%	8	12.1%	29	12.4%
Financial services	7	2.3%	2	3.0%	5	2.1%
IT	35	11.7%	12	18.2%	23	9.8%
Manufacturing	38	12.7%	4	6.1%	34	14.5%
Oil/Gas	31	10.3%	5	7.6%	26	11.1%
Petrochemical	38	12.7%	6	9.1%	32	13.7%
Retail	30	10.0%	2	3.0%	28	12.0%
Telecommunications	14	4.7%	6	9.1%	8	3.4%
Other	25	8.3%	7	10.6%	18	7.7%
Market scope:						
International	132	44.0%	45	68.2%	87	37.2%
Local	120	40.0%	9	13.6%	111	47.4%
National	48	16.0%	12	18.2%	36	15.4%

7.1.3 The Reliability of the Instrument

In order to increase the precision of this study, Cronbach's alpha was used to assess the reliability of the instrument used in this study. Table 7-2 presents the values of Cronbach's alpha for all constructs. Overall, the results show that the Cronbach's alpha coefficient value for eight constructs (quality of service, security, relative advantage, trialability, top management support, physical location, external support and intention to adopt cloud) was above 0.80, which means the reliability of these constructs was very good, as high values of Cronbach's alpha indicates very good internal consistency of items.

Moreover, the Cronbach's alpha values for privacy, technology readiness, compliance with regulations, industry and culture ranged between 0.70 and 0.80, which are considered to be acceptable values. The results show that the value for privacy will be raised to 0.798 if the item P4 is deleted and the value for compliance with regulations will improved from 0.717 to 0.743, if item CR3 is excluded. The result for culture will be improved to 0.752 by excluding item CU4, as shown in Table 7-2.

Moreover, the reliability value for compatibility was 0.647, which might be seen as acceptable and the results show if C4 was deleted from the compatibility construct, the Cronbach's Alpha value for compatibility will be increased from 0.647 to 0.812. On other hand, trust has the lowest Cronbach Alpha value, which is (0.545); however, this result could be enhanced to an acceptable value (0.601), by removing only one item (i.e., T4) from the trust construct.

Thus, although the results show that the Cronbach's Alpha values for privacy, trust, compatibility compliance with regulations and culture will be increased by excluding the following items (P4, T4, C4, CR3, CU4), as this is an early stage of analysis, these items will not be removed. Further analysis and tests for reliability will be carried out during the analyses of measurement model, which is an important stage in SEM (Kline, 2011).

Table 7-2 Cronbach's alpha reliability analysis.

Construct	Number of item	Items' Code	Cronbach's alpha	Cronbach's alpha value if item deleted
Technological Factors				
Quality of Service (QS)	6	QS1, QS2, QS3, QS4, QS5, QS6	0.867	
Security (S)	4	S1, S2, S3, S4	0.831	
Privacy (P)	4	P1, P2, P3, P4	0.740	0.798
Trust (T)	4	T1, T2, T3, T4	0.545	0.601
Relative Advantage (RA)	4	RA1, RA2, RA3, RA4	0.813	
Compatibility (C)	4	C1,C2, C3, C4	0.647	0.812
Trialability (TA)	4	TA1,TA2, TA3, TA4	0.827	
Organisational Factors				
Top Management Support (TMS)	4	TMS1,TMS2, TMS3, TMS4	0.821	
Technology Readiness (TR)	6	TR1, TR2, TR3, TR4,TR5,TR6	0.772	
Environmental Factors				
Compliance with Regulations (CR)	4	CR1, CR2, CR3,CR4	0.717	0.743
Physical Location (PL)	4	PL1, PL2, PL3, PL4	0.834	
External Support (ES)	5	ES1, ES2, ES3, ES4, ES5	0.883	
Industry (I)	3	I1, I2, I3	0.763	
Social factor				
Culture (CU)	4	CU1, CU2, CU3, CU4	0.748	0.752
Intention to Adopt Cloud (IAC)	4	IAC1, IAC2, IAC3, IAC4	0.855	

7.2 Structural Equation Modelling (SEM)

In this study, the SEM analysis technique was used to test the developed model for cloud adoption and to measure the strength of the relationships between independent and dependent variables, as well as to assess how good this model is. This section presents the results of analysing the proposed model using two level of analysis, measurement level and structural level. AMOS software was used for analysing data through SEM, this is due to the availability of this software as well as its features that meet the requirements for this study (Byrne, 2010).

7.2.1 Analysis of the Measurement Model

It is important to verify the reliability of an instrument and ensure the quality of the measures before conducting any other statistical analysis. At measurement level, the relationships between latent variables and their indicators were assessed. As mentioned earlier, in Chapter 6, the latent variables refer to all factors in the proposed model, including intention to adopt the cloud, while the indicator variables refer to the items (i.e., questions) used to measure these factors. In this research, each latent variable was measured using more than two items. For example, security was measured using four items; S1, S2, S3 and S4. Overall, in this study, the measurement analysis was conducted using 15 latent variables (unobserved variables) and these variables were measured by 64 items (observed variables or indicators). Table 7-3 shows the latent variables used in this study and their indicators. These observed variables (indicators) have been adopted from former studies. However, some other variables have been added which were constructed by the researcher and which had not been mentioned in previous studies. The composite reliability and construct validity were verified in this study and the results will be presented in the sections below.

Table 7-3 Latent variables and their indicators.

Latent Variables	Indicators (Measured Variables)
Quality of Service (QS)	QS1, QS2, QS3, QS4, QS5, QS6
Security (S)	S1, S2, S3, S4
Privacy (P)	P1, P2, P3, P4
Trust (T)	T1, T2, T3, T4
Relative Advantage (RA)	RA1, RA2, RA3, RA4
Compatibility (C)	C1,C2, C3, C4
Trialability (TA)	TA1,TA2, TA3, TA4
Top Management Support (TMS)	TMS1,TMS2, TMS3, TMS4
Technology Readiness (TR)	TR1, TR2, TR3, TR4,TR5,TR6
Compliance with Regulations (CR)	CR1, CR2, CR3,CR4
Physical Location (PL)	PL1, PL2, PL3, PL4
External Support (ES)	ES1, ES2, ES3, ES4, ES5
Industry (I)	I1, I2, I3
Culture (CU)	CU1, CU2, CU3, CU4
Intention to Adopt Cloud (IAC)	IAC1, IAC2, IAC3, IAC4

7.2.1.1 Composite Reliability

Composite reliability it is also called construct reliability, which is an important step in SEM, and, according to Bentler (2007), the study will be misleading if this step is not taken into consideration. The composite reliability *"it measures reliability and internal consistency of the measured variables representing a latent construct"* (Hair et al. 2010). To measure the reliability of the construct, composite reliability was computed by using the following formula, as proposed by Hair et al. (2010).

$$\text{Composite Reliability} = \frac{(\sum_{i=1}^{n} L_i)^2}{(\sum_{i=1}^{n} L_i)^2 + \sum_{i=1}^{n} \boldsymbol{e_i}} \qquad (1)$$

In equation (1), Li is standardised factor loading, the number of items is n and $\boldsymbol{e_i}$ is the error variance term for a construct. Factor loading of variables (Li), indicate the path between measured items (observed variables) and their construct.

The value of composite reliability above 0.7 is considered to be highly reliable and between 0.6 and 0.7 is acceptable (Nunnally and Bernstein, 1994; Hair et al. 2010). Table 7-4 presents the composite reliability values for all the latent variables. The results show that the composite reliability values for most constructs were higher than 0.7, which means they exceeded the minimum threshold. However, the composite reliability value for trust was (0.630), which is still considered an acceptable value. Overall, all the constructs were reliable and further analysis will be carried out in this study and the results will be presented in next sections.

Table 7-4 Composite reliability analysis of the construct variables.

Constructs	Observed variables	Standardised factor loading	Error variance	Composite Reliability (CR)
Quality of Service (QS)	QS1	0.710	0.22	0.928
	QS2	0.747	0.21	
	QS3	0.732	0.23	
	QS4	0.705	0.27	
	QS5	0.680	0.32	
	QS6	0.767	0.24	
Security (S)	S1	0.835	0.32	0.848
	S2	0.814	0.34	
	S3	0.611	0.46	
	S4	0.710	0.45	
Privacy (P)	P1	0.600	0.49	0.798
	P2	0.825	0.30	
	P3	0.847	0.33	
	P4	0.331	0.59	
Trust (T)	T1	0.817	0.26	0.630
	T2	0.722	0.35	
	T3	0.275	0.60	
	T4	0.090	0.91	
Relative Advantage (RA)	RA1	0.778	0.21	0.888
	RA2	0.646	0.33	
	RA3	0.746	0.28	
	RA4	0.724	0.23	
Compatibility (C)	C1	0.764	0.22	0.793
	C2	0.759	0.19	
	C3	0.780	0.24	
	C4	0.212	0.99	
Trialability (TA)	TA1	0.765	0.18	0.908
	TA2	0.772	0.19	
	TA3	0.714	0.29	
	TA4	0.717	0.23	

Constructs	Observed variables	Standardised factor loading	Error variance	Composite Reliability (CR)
Top Management Support (TMS)	TMS1	0.712	0.28	0.897
	TMS2	0.738	0.22	
	TMS3	0.785	0.19	
	TMS4	0.703	0.30	
Technology Readiness (TR)	TR1	0.680	0.28	0.784
	TR2	0.758	0.23	
	TR3	0.726	0.23	
	TR4	0.376	1.00	
	TR5	0.518	0.51	
	TR6	0.404	1.04	
Compliance with Regulations (CR)	CR1	0.809	0.14	0.836
	CR2	0.866	0.11	
	CR3	0.414	0.66	
	CR4	0.504	0.40	
Physical Location (PL)	PL1	0.699	0.32	0.883
	PL2	0.828	0.23	
	PL3	0.791	0.27	
	PL4	0.630	0.33	
External Support (ES)	ES1	0.804	0.16	0.938
	ES2	0.825	0.15	
	ES3	0.774	0.22	
	ES4	0.741	0.23	
	ES5	0.734	0.23	
Industry (I)	I1	0.723	0.32	0.829
	I2	0.784	0.25	
	I3	0.666	0.40	
Culture (CU)	CU1	0.676	0.27	0.844
	CU2	0.701	0.37	
	CU3	0.748	0.32	
	CU4	0.491	0.30	
Intention to Adopt Cloud (IAC)	IAC1	0.859	0.17	0.902
	IAC2	0.845	0.19	
	IAC3	0.724	0.37	
	IAC4	0.676	0.31	

7.2.1.2 Construct Validity

Assessing the validity of the construct is an essential step in SEM that increases the precision of the research. Hair et al. (2010) defined the construct validity as: *"the extent to which a set of measured items actually represent the theoretical latent construct those items are designed to measure"*. The construct validity could be assessed through a variety of methods in order to avoid random error and method variance (Bagozzi & Yi, 1991). Therefore, in this study the construct validity will be evaluated using convergent validity, discriminant validity and nomological validity (Straub et al., 2004 and Hair et al., 2010). The results will be presented in detail in the following sections.

7.2.1.2.1 Convergent Validity

Convergent validity is utilised to evaluate correlation between measured variables of the same construct (Straub et al., 2004; Robins et al., 2009; Pallant, 2011). A high correlation between items of the same construct means those items are representing their intended construct very well (Hair et al., 2010).

In this present study the convergent validity was assessed through utilising Average Variance Extracted (AVE). AVE is one of the common methods used for evaluating convergent validity, and was proposed by Fornell and Larcker (1981). The following equation was used for calculation of AVE, as suggested by Hair et al. (2010).

$$\text{Average Variance Extracted (AVE)} = \frac{\sum_{i=1}^{n} L_i^2}{n} \quad (2)$$

In formula (2), L_i is the standardised factor loading, and n represents the number of items.

There are two different types of factor loading in SEM, one known as standardised factor loading and the other one known as unstandardised factor loading. However, researchers take into consideration standardised factor loading in most cases, because the estimation ranges of standardised factor loading are between -1 and +1, while in unstandardised factor loading their range has no bounds and also represents covariance (Hair et al., 2010). Therefore, in this study the composite reliability and AVE were calculated using standardised factor loading.

The acceptable value of standardised factor loading is 0.5 or above and the ideal loading is 0.7 or higher. According to Hair et al. (2010), the value of the AVE will be improved by excluding any item (measured variable) which has a standardised factor loading less than 0.5, as a rule of thumb.

The AVE was calculated for each item in a construct and the results are presented in Table 7-5. The acceptable value of AVE is 0.5 or higher (Hair et al., 2010), and it is clear from the results that the AVE values for most of the constructs are 0.5 or higher. However, the AVE values for privacy, trust, compatibility, technology readiness, compliance with regulations, and culture were less than the acceptable value (0.5), which means there is an error remains in these variables. By deleting items for which the factor loading was less than 0.5, the AVE values for privacy, trust, compatibility, compliance with regulations, and culture were

improved, but the AVE of technology readiness (0.458) remains below 0.5. However, the results show that after excluding two items of technology readiness (TR4 and TR6) from the proposed model, the factor loading for item TR5 dropped to (0.421), as shown in Table 7-5, which is clearly less than 0.5. Therefore, this item (TR5) was excluded and the AVE value of technology readiness increased to an acceptable value.

Table 7-5 The analysis of convergent validity.

Constructs	Observed variables	Standardised factor loading	AVE	Items deleted	AVE after deleting items	Standardised factor loading after deleting items	AVE after deleting items
Quality of Service (QS)	QS1	0.710	0.524				
	QS2	0.747					
	QS3	0.732					
	QS4	0.705					
	QS5	0.680					
	QS6	0.767					
Security (S)	S1	0.835	0.559				
	S2	0.814					
	S3	0.611					
	S4	0.710					
Privacy (P)	P1	0.600	0.466	P4	0.586		
	P2	0.825					
	P3	0.847					
	P4	0.331*****					
Trust (T)	T1	0.817	0.318	T3,T4	0.594		
	T2	0.722					
	T3	0.275*****					
	T4	0.090*****					
Relative Advantage (RA)	RA1	0.778	0.525				
	RA2	0.646					
	RA3	0.746					
	RA4	0.724					
Compatibility (C)	C1	0.764	0.453	C4	0.589		
	C2	0.759					
	C3	0.780					
	C4	0.212*****					
Trialability (TA)	TA1	0.765	0.551				
	TA2	0.772					
	TA3	0.714					
	TA4	0.717					
Top Management Support (TMS)	TMS1	0.712	0.540				
	TMS2	0.738					
	TMS3	0.785					
	TMS4	0.703					
Technology Readiness (TR)	TR1	0.680	0.356	TR4,TR 6,TR5	0.458	0.718	0.555
	TR2	0.758				0.810	
	TR3	0.726				0.704	
	TR4	0.376*****					
	TR5	0.518				0.421*****	
	TR6	0.404*****					

Constructs	Observed variables	Standardised factor loading	AVE	Items deleted	AVE after deleting items	Standardised factor loading after deleting items	AVE after deleting items
Compliance with Regulations (CR)	CR1	0.809	0.457	CR3	0.552		
	CR2	0.866					
	CR3	0.414*****					
	CR4	0.504					
Physical Location (PL)	PL1	0.699	0.549				
	PL2	0.828					
	PL3	0.791					
	PL4	0.630					
External Support (ES)	ES1	0.804	0.602				
	ES2	0.825					
	ES3	0.774					
	ES4	0.741					
	ES5	0.734					
Industry (I)	I1	0.723	0.526				
	I2	0.784					
	I3	0.666					
Culture (CU)	CU1	0.676	0.437	CU4	0.502		
	CU2	0.701					
	CU3	0.748					
	CU4	0.491*****					
Intention to Adopt Cloud (IAC)	IAC1	0.859	0.608				
	IAC2	0.845					
	IAC3	0.724					
	IAC4	0.676					

***Note:** standardised factor loading <0.5.

7.2.1.2.2 Discriminant Validity

Discriminant validity refers to *"extent to which a construct is truly distinct from other constructs both in term of how much it correlates with other constructs and how distinctly measured variables represent only this single construct"* (Hair et al., 2010). There are two approaches for testing discriminant validity: either by comparing the square root of AVE with the correlation between the construct and another construct or by comparing the AVE value for each construct with the squared correlation estimate between two constructs (Fornell and Larcker, 1981; Hair et al., 2010).

The discriminant validity was assessed in this study through comparing the square root of AVE with correlations between the constructs. To demonstrate discriminant validity, the value of the square root of AVE for each latent construct should be greater than the value of correlations estimated between the constructs (Fornell and Larcker, 1981).

Table 7-6 presents the results of calculating discriminant validity. It is clear from the results that the value of the square root of AVE for all latent constructs, as highlighted in Table 7-6, was higher than the correlation between these constructs. On the whole, the results showed adequate evidence of the discriminant validity of the latent constructs.

Table 7-6 Discriminant validity test of the identified constructs in Table 7-5.

	I	ES	PL	TR	TMS	CU	TA	C	RA	T	S	QS	CR	P	IAC
I	**0.725**														
ES	0.537	**0.775**													
PL	0.635	0.491	**0.740**												
TR	0.412	0.649	0.642	**0.744**											
TMS	0.417	0.397	0.487	0.476	**0.734**										
CU	0.527	0.299	0.731	0.519	0.309	**0.708**									
TA	0.496	0.696	0.519	0.656	0.459	0.369	**0.742**								
C	0.630	0.601	0.595	0.708	0.416	0.558	0.651	**0.767**							
RA	0.621	0.552	0.505	0.436	0.333	0.357	0.549	0.754	**0.724**						
T	0.432	0.352	0.441	0.479	0.217	0.420	0.413	0.713	0.596	**0.770**					
S	0.215	-.028	0.546	0.165	0.204	0.562	0.031	0.112	0.025	0.093	**0.747**				
QS	0.504	0.560	0.414	0.480	0.253	0.298	0.521	0.669	0.653	0.354	0.032	**0.723**			
CR	0.466	0.360	0.733	0.471	0.357	0.536	0.380	0.436	0.370	0.323	0.401	0.304	**0.742**		
P	0.351	0.271	0.553	0.355	0.269	0.404	0.287	0.329	0.279	0.244	0.302	0.229	0.233	**0.765**	
IAC	0.416	0.424	0.404	0.496	0.222	0.317	0.432	0.617	0.512	0.546	-.019	0.656	0.273	0.289	**0.779**

7.2.1.2.3 Nomological validity

After evaluating convergent and discriminant validities in previous sections, nomological validities will be discussed in this section. Nomological validity studies the relationship between the constructs according to theoretical support (Hair et al., 2010).

To claim nomological validity, the relationship between the variables should make sense, as hypothesised in the proposed model for cloud adoption. Since the relationships between constructs (hypotheses) will be assessed through the structural model in the next section, it is early to examine these relationships in this stage. Overall, the measurement model provides the evaluation of convergent validity and discriminant validity, while the structural model presents the assessment of nomological validity (Schumacker & Lomax, 2004).

7.2.2 Structural Model Analysis

The structural model is the next step after evaluating the measurement model (composite reliability and construct validity) in the previous sections. In this stage, the relationships among the latent constructs will be examined. On other word, the hypotheses paths will be

assessed at this stage. The analysis focuses on the relationships among construct variables instead of relationships between construct variables and their measured variables (indicators). Table 7-7 shows the hypotheses paths that will be tested in the structural model. The analysis of the proposed model at structural level has been divided into four sections. The first section presents the results of evaluating model fit and the next sections provide the results of assessing the relationships among construct variables, as well as the results of assessment of the moderating variable. The final section shows the difference between organisations that had already adopted the cloud and non-adopters.

Table 7-7 The hypotheses paths in the structural model.

Construct	**Hypotheses**	**Hypothesised Relationships**
Quality of Service (QS)	H1 (+)	QS → IAC
Security (S)	H2 (-)	S → IAC
Privacy (P)	H3 (-)	P → IAC
Trust (T)	H4 (+)	T → IAC
Relative Advantage (RA)	H5 (+)	RA → IAC
Compatibility (C)	H6 (+)	C → IAC
Trialability (TA)	H7 (+)	TA → IAC
Top Management Support (TMS)	H8 (+)	TMS → IAC
Technology Readiness (TR)	H9 (+)	TR → IAC
Compliance with Regulations (CR)	H10 (+)	CR → IAC
Physical Location (PL)	H11 (+)	PL → IAC
	H11.1	PL → CR
	H11.2	PL → P
External Support (ES)	H12 (+)	ES → IAC
Industry (I)	H13	I → IAC
Culture (CU)	H14 (+)	CU → IAC
Intention to Adopt Cloud (IAC)		

7.2.2.1 Structural Model Goodness of Fit (GoF)

Goodness of Fit (GoF) is an essential step in SEM, which is always used to assess how well the proposed model fits with the collected data (Tabachnick and Fidell, 2013). The results of GoF are estimated through comparison of observed data (sample covariance matrix) with proposed hypotheses (predicted model covariance). There are different types of indices which can be used to examine model fit, which are divided into four types: the basics of goodness of fit indices, absolute fit indices, incremental fit indices and parsimony fit indices (Hair et al., 2010). Hair et al. (2010) suggest that the basics of goodness of fit indices and at least one of the absolute fit indices and one of the incremental fit indices should be indicated to provide sufficient evidence of model fit.

The basics of goodness of fit indices refers to chi-square (x^2) and degrees of freedom (df). The chi-square (x^2) test is an essential statistical test in SEM which should always be reported (Hu and Bentler, 1999). The chi-square (x^2) test examines the difference between the collected data (sample covariance matrix) and predicted model covariance matrix (Khine, 2013).

However, the value of chi-square (x^2) is sensitive to the size of the sample and increases with large numbers of samples (Kline, 2011). Thus, depending on the size of the sample, the chi-square test (x^2) can be misleading (MacCallum, 1990; Byrne, 2001; Hair et al., 2006). Therefore, normed chi-square and degree of freedom (df) should be evaluated and reported in this study. The normed chi-square was developed to address this problem, by reducing dependency on sample size.

Since the value of chi-square (x^2) is affected by sample size, normed chi-square will be calculated in this study, through dividing the value of chi-square (x^2) by degrees of freedom (df) **(**Kline, 2011). Also, if the study sample size is more than 250, the value of the normed chi-square should be lower than 3 to show model fit (Hair et al., 2010). In this study the sample size was 300 and the value of normed chi-square was (1.51), as shown in Table 7-8, which is within the recommended level.

However, as mentioned above, reporting chi-square (x^2) and normed chi-square tests alone is not adequate evidence of model fit and most researchers recommend that three to four fit

indices should be reported, in addition to chi-square (x^2) (Carmines and McIver, 1981; Hu and Bentler, 1998; Hair et al., 2010). Therefore, this study will present the most recommended indices for GoF, which are usually reported by researchers in information systems studies.

Root Mean Square Error of Approximation (RMSEA) is one of the most popular absolute fit indices that is usually used with complex models which have large numbers of observed variables as well as a large sample size. The lower values of RMSEA indicate a better fit. Steiger (2007) and Hair et al. (2010) suggest that the RMSEA value should be lower than 0.07 if the study has a sample size of more than 250 and the number of measured variables is more than 30.

The second type of absolute fit indices that are usually reported by researchers is Root Mean Square Residual (RMR) and Standardised Root Mean Square Residual (SRMR). The RMR represents the average of the residuals, while SRMR is a standardised value of RMR (Hair et al., 2010). The accepted value of RMR is lower than 0.1, and the value of SRMR should be lower than 0.08 to represent a good fitting of the model (Kline, 2011).

In terms of incremental fit indices, Comparative Fit index (CFI) and the Tucker-Lewis Index (TLI) are the most recommended indices that should be reported in this study to estimate GoF. CFI is one of the less affected indices to the sample size (Fan et al., 1999), which is compares the collected data (sample covariance matrix) with the null model (Hooper et al., 2008). For demonstrating a good fit of model, the value of CFI needs to be greater than or equal to 0.90 (Hu and Bentler, 1999; Hair et al., 2010). TLI compares the values of the normed chi-square for the null model with those of the specified model (Hair et al., 2010). The range value of TLI is between 0 and 1, and a model is well-fitting when the TLI value is above 0.90 (Hu and Bentler, 1998; Hair et al., 2010).

In this research, the estimation technique which is used for calculation of GoF indices is Maximum Likelihood (ML) as this technique is more efficient and preferred by most researchers over other estimation methods. The tool used for analysis is AMOS (version 22).

Overall, in this study RMSEA, RMR, SRMR, CFI and TLI indices, together with the chi-square (x^2), degree of freedom (df) and normed chi-square values were used to evaluate

model fit. The sample size of this study was 300, and the number of measured variables was more than 30 items. Table 7-8 shows the results and satisfies the criteria of using these indices in sample sizes more than 250 and number of indicators more than or equal to 30. The values of absolute fit indices RSMEA (0.042), RMR (0.047) and SRMR (0.067) were within the threshold level and the values of incremental fit indices CFI (0.922) and TLI (0.912), were above the minimum level. In summary, the values of these GoF indices, as shown in Table 7-8 confirm that the proposed model is well-fitting with the collected data.

Table 7-8 Goodness of Fit indices of the structural model.

Fit Indices	**The Proposed Model Fit**	**Benchmark**
chi-square (x^2)	1994.348	
df	1315	
p	< 0.001	
Absolute Fit Indices		
Normed chi-square x^2/df	1.51	< 3.00
RMSEA	0.042	< 0.07
RMR	0.047	< 0.1
SRMR	0.067	< 0.08
Incremental Fit Indices		
CFI	0.922	≥ 0.90
TLI	0.912	≥ 0.90

***Note:** benchmark for sample size > 250 and observed variables ≥ 30 (Hair et al., 2010).

7.2.2.2 Assessment of Latent Variable Relations

The next step after confirming the proposed model has a good fit with observed data in previous section is examining the hypothetical relations between construct variables. In this study, the relations among latent variables were assessed through standardised path coefficient (β) (regression coefficient), Critical Ratio (C.R.), p-value and squared multiple correlations (R^2) (Hair et al., 2010).

The standardised path coefficient (β), indicates the effect size for each variable in the model. A value of standardised path coefficient (β) which is less than 0.1 represents a small effect, while a large effect is represent by large values (greater than 0.5) (Suhr, 2008). Critical Ratio (C.R.) is also called T-value or Z-value. The T-value is calculated via dividing the unstandardised regression coefficient by standard error (S.E.). According to Hair et al. (2010), if the value of T-value is greater than or equal to 1.96, the coefficient value is considered to be significant at the 0.05 level. Furthermore, the p-value shows how statistically significant the relationships are among construct variables at the level 0.05.

The squared multiple correlations (R^2) indicate "*the proportion of variance that is explained by the predictors of the variable in question"* (Byrne, 2010). The range of squared multiple correlations (R^2) values is between 0 and 1 and there is a stronger relationship when the value is close to 1 (Tabachnick and Fidell, 2013).

Table 7-9 presents the results for all hypotheses. The results show that that the paths for hypotheses H1, H4, H11.1, and H11.2 were statistically significant and have a positive effect. The relationship between security (H2), privacy (H3) and organisational intention to adopt the cloud were also statistically significant. However, the effect of these variables on the adoption decision were negative.

On other hand, the p-values for the path estimated for hypotheses H5, H6, H7, H8, H12 and H14 were greater than 0.05. This means that relative advantage, compatibility, trialability, top management support, external support and culture all had a negative indirect effect on an organisation's decision to adopt cloud technology.

Furthermore, the results clearly show that the paths of hypotheses H9, H10, H11 and H13 were positive and not statistically significant (p-values > 0.05). This result indicates that the effects of technology readiness compliance with regulations, physical location and industry on an organisation's intention to adopt the cloud were indirect.

Table 7-10 show the values of the squared multiple correlations (R^2). The highest variance in intention to adopt cloud (R^2 = 0.586), indicates that 58.6% of the variance in intention to adopt cloud is significantly explained by these independent factors. These findings show that the proposed model is statistically significant in explain cloud technology adoption at organisational level. In this study, physical location is found to have a positive effect on compliance with regulations. The squared multiple correlation (R^2) value of the endogenous variable (compliance with regulations) was (0.538), and this result shows that physical location explains 53.8% of the compliance with regulations. Furthermore, physical location has a significant impact on privacy. As shown in Table 7-10, the squared multiple correlation (R^2) value for privacy is 0.306. This value indicates that 30.6% of the variance in privacy is significantly explained by physical location. Table 7-11 presents the correlation between latent variables in the research model.

Table 7-9 The analysis of hypotheses paths.

	Hypothesised Path	β	C.R.	P
H1 (+)	QS → IAC	0.564	6.228	<0.001
H2 (-)	S → IAC	-.174	-2.163	0.031
H3 (-)	P → IAC	-0.139	-2.045	0.041
H4 (+)	T → IAC	0.363	3.675	<0.001
H5 (+)	RA → IAC	-.135	-1.235	0.217
H6 (+)	C → IAC	-.017	-.094	0.925
H7 (+)	TA → IAC	-.031	-.366	0.714
H8 (+)	TMS → IAC	-.006	-.090	0.928
H9 (+)	TR → IAC	0.118	0.942	0.346
H10 (+)	CR → IAC	0.034	0.403	0.687
H11 (+)	PL → IAC	0.043	0.231	0.817
H11.1	PL → CR	0.733	9.231	<0.001
H11.2	PL → P	0.553	7.857	<0.001
H12 (+)	ES → IAC	-.078	-.880	0.379
H13	I → IAC	0.020	0.213	0.832
H14 (+)	CU → IAC	-.010	-.100	0.920

Table 7-10 Squared multiple correlations (R^2).

Construct	R^2
Intention to Adopt Cloud (IAC)	0.586
Compliance with Regulations (CR)	0.538
Privacy (P)	0.306

Table 7-11 Correlation between latent variables.

Latent variables	Correlation	Latent variables	Correlation
QS <--> S	.032	RA <--> TR	.436
QS <--> T	.354	RA <--> PL	.505
QS <--> RA	.653	RA <--> ES	.552
QS <--> C	.669	C <--> CU	.558
QS <--> TA	.521	C <--> TMS	.416
QS <--> CU	.298	C <--> PL	.595
QS <--> TMS	.253	C <--> ES	.601
QS<--> TR	.480	C <--> I	.630
QS <--> PL	.414	TA <--> RA	.549
QS <--> ES	.560	TA <--> C	.651
QS <--> I	.504	TA <--> CU	.369
S <--> T	.093	TA <--> TMS	.459
S <--> RA	.025	TA <--> PL	.519
S <--> C	.112	TA <--> ES	.696
S <--> TA	.031	TA <--> I	.496
S <--> TMS	.204	CU <--> TMS	.309
S <--> TR	.165	CU <--> T	.420
S <--> ES	-.028	CU <--> ES	.299
S <--> I	.215	TMS <-->TR	.476
T <--> RA	.596	TMS <--> PL	.487
T <--> TA	.413	TMS <--> ES	.397
T <--> TMS	.217	TMS <--> I	.417
T <--> TR	.479	TR <--> PL	.642
T <--> PL	.441	TR <--> ES	.649
T <--> ES	.352	TR <--> I	.412
T <--> I	.432	PL <--> S	.546
RA <--> CU	.357	PL <--> ES	.491
RA<--> TMS	.333	ES <--> I	.537

7.2.2.3 Assessment of Moderating Variable

The relationship in the proposed model is still not fully assessed. The moderating variable that affect latent variables need evaluation. In the proposed model, the organisation's size is a moderating effect on 14 factors:

- Technological factors: quality of service, security, privacy, trust, relative advantage, compatibility, and trialability.
- Organisational factors: top management support, and technology readiness.
- Environmental factors: compliance with regulations, physical location, external support, and industry.
- Social factor: culture.

In this study, the effect of this moderating variable (organisation size) was analysed by using the multi-group test in SEM. Thus, to enable a multi-group analysis test, the data for the variable organisation size was recoded into two groups: SME (1-250 employees) and large enterprises (more than 250 employees).

Also, the hypothesis of this moderator was assessed, as with previous assessment of the construct variables' relationships in the former section, by evaluating the following variables standardised path coefficient (β), C.R. (T-value) and p-value at the level 0.05. Table 7-12 presents the results of the effect of this moderating variable.

The results show that the size of the organisation had a significant interaction with the relationship between quality of service and organisational intention to adopt the cloud; it also had a significant positive interaction with the relationship between physical location and compliance with regulation and the effect of physical location upon privacy.

Furthermore, for SME, the results show that the security, privacy and technology readiness each had a statistically significant direct effect on an organisation's intention to adopt cloud technology, whereas, with the larger-sized enterprises, the effect of these factors was indirect. In addition, the technology readiness had a positive impact on an organisation's decision to employ cloud technology, while the effect of the security and privacy was negative in organisations of all sizes (SME and large). One the other hand, there was a positive interaction between the size of the organisation and trust in affecting an organisation's intention to adopt cloud technology. As shown in Table 7-12, the relationship was significant (direct) in large enterprises, whereas in SME there is no direct relationship. The effect was slightly stronger in large enterprises (β= 0.51) than in SME (β=0.25). Figure 7-1 shows the path diagram of the proposed structural model.

Table 7-12 The effect of organisation size on the construct variables.

		SME N= 152			Large N= 148		
Hypothesis Path		**β**	**C.R.**	**P**	**β**	**C.R.**	**P**
H1a	QS →I AC	1.059	2.347	0.019	0.539	3.819	<0.001
H2a	S→ IAC	-.504	-2.018	0.044	-.094	-.776	0.438
H3a	P→ IAC	-0.224	-2.840	0.005	-0.088	-1.169	0.242
H4a	T→ IAC	0.256	.602	0.547	0.512	3.205	<0.001
H5a	RA→ IAC	-1.309	-1.618	0.106	-.176	-1.183	0.237
H6a	C→ IAC	0.774	1.323	0.186	-.213	-.418	0.676
H7a	TA→ IAC	-.610	-1.681	0.093	0.115	.927	0.354
H8a	TMS→ IAC	-.060	-.245	0.807	-.054	-.549	0.583
H9a	TR→ IAC	0.981	2.115	0.034	0.042	0.160	0.873
H10a	CR→ IAC	0.012	.142	0.887	0.104	1.236	0.216
H11a	PL→ IAC	0.474	1.304	0.192	-.067	-.313	0.754
H11.1a	PL→ CR	0.629	5.546	<0.001	0.550	5.411	<0.001
H11.2a	PL→ P	0.479	4.848	<0.001	0.381	3.901	<0.001
H12a	ES→ IAC	-.395	-1.644	0.100	-.024	-.153	0.878
H13a	I→ IAC	0.117	0.447	0.655	0.263	1.23	0.219
H14a	CU→ IAC	-.196	-.718	0.473	-.112	-.453	0.651

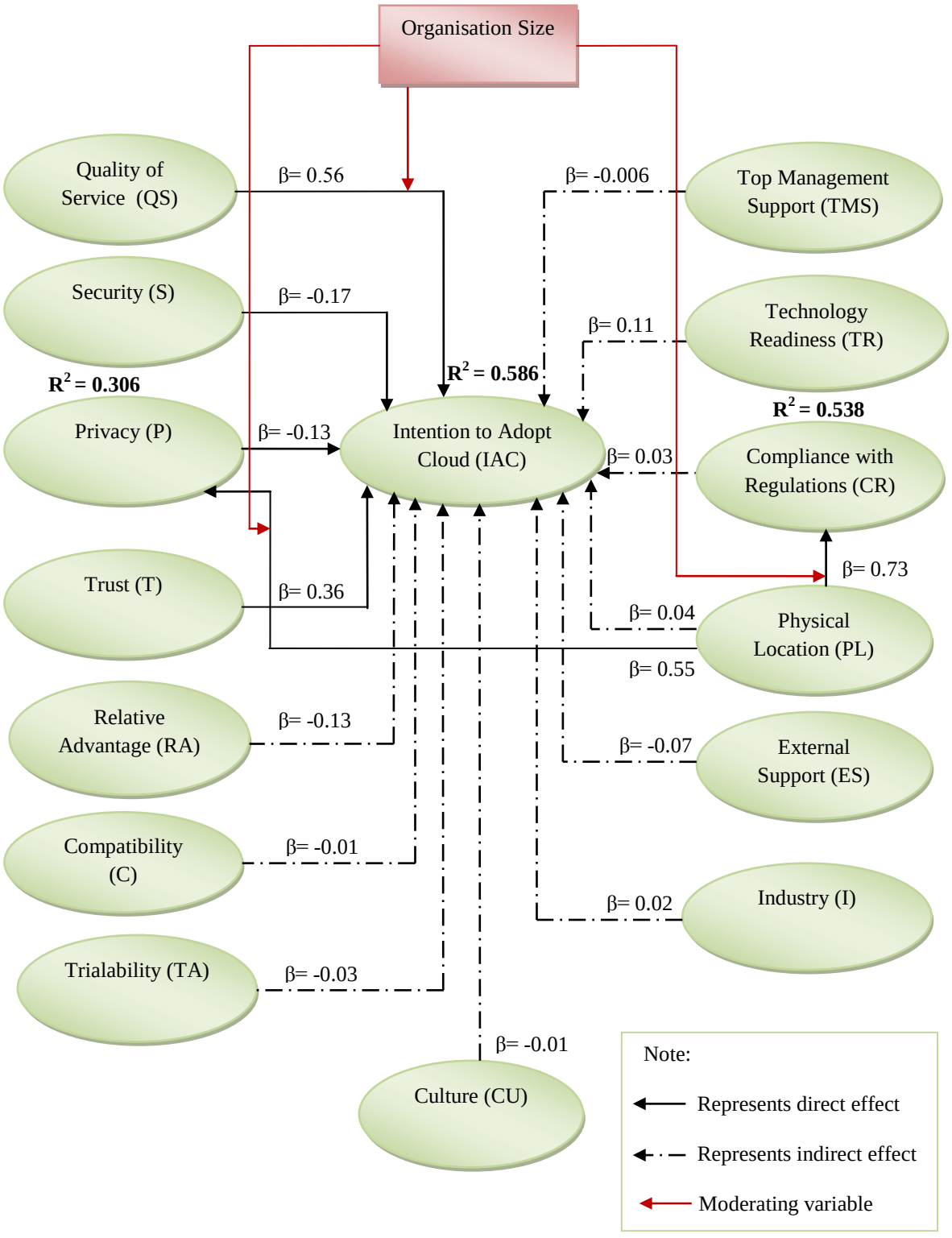

Figure 7-1 The path diagram of the proposed structural model.

7.2.2.4 Adopters versus Non-adopters

In this study, most of the participants (78%) were working in organisations that had not already adopted cloud technology, whereas only 22% of them already utilised cloud computing. A further analysis was therefore, conducted to investigate the differences between companies that had already adopted cloud services and non-adopters. The analysis was carried out through multi-group analysis in SEM. The differences between two groups (adopters and non-adopters) were evaluated by path coefficient (β), C.R. (T-value) and p-value at the level 0.05. The results are presented in Table 7-13.

It clear from the results that the effect of quality of services was positive and statistically significant for both groups (adopters and non-adopters) and this factor had a stronger effect in organisations that utilised cloud computing, β= 0.775 than in non-adopters β= 0.499. Moreover, physical location had a direct significant impact on compliance with regulation and privacy in all groups. The results show the impact of physical location on compliance with regulation as well as, upon privacy was stronger in non-adopters compared to adopters.

Moreover, security, privacy, trust and technology readiness were found to have a significant (direct) impact in organisations' decisions to adopt the cloud, whereas the effect of these variables was indirect in organisations where cloud services were being used. It is interesting to note that the impact of technology readiness was negative in non-adopter companies and stronger in adopters than non-adopters, the standardised regression weight for non-adopters was β= -0.34, and β= 0.43 for companies that were adopters.

For both groups, the analysis shows that the effects of relative advantage, compatibility, trialability, top management support and compliance with regulation were indirect and the effect was stronger on adopters than non-adopters, as shown in Table 7-13. However, the impact of these factors was negative in organisations that had not yet adopted cloud technology. This means these factors could be impeding them from utilising cloud services.

Table 7-13 Difference between adopter and non-adopter companies.

		Adopters N= 66			Non-adopters N= 234		
Hypothesis Path		**β**	**C.R.**	**P**	**β**	**C.R.**	**P**
H1	QS →I AC	0.775	1.973	0.049	0.499	5.052	<0.001
H2	S→ IAC	-.056	-.310	.757	-.136	-2.078	0.038
H3	P→ IAC	-0.080	-0.869	0.385	-0.139	-2.042	0.041
H4	T→ IAC	0.377	0.820	0.412	0.304	3.376	<0.001
H5	RA→ IAC	.630	.985	0.325	-.081	-.756	0.450
H6	C→ IAC	0.925	1.526	0.127	-.061	-.394	0.694
H7	TA→ IAC	.178	.997	0.319	-.065	-.668	0.504
H8	TMS→ IAC	.152	.706	0.480	-.062	-.916	0.360
H9	TR→ IAC	.437	1.543	0.123	-0.342	-2.725	0.006
H10	CR→ IAC	0.120	1.283	0.200	-.022	-.286	0.775
H11	PL→ IAC	0.099	.475	0.635	0.039	0.322	0.747
H11.1	PL→ CR	0.389	2.000	0.046	0.720	8.828	<0.001
H11.2	PL→ P	0.299	2.079	0.038	0.481	6.465	<0.001
H12	ES→ IAC	-.107	-.162	0.871	-.165	-1.786	0.074
H13	I→ IAC	.009	.021	0.984	0.111	1.043	0.297
H14	CU→ IAC	-.100	-.420	0.674	-.031	-.262	0.794

7.3 Assessment of Hypotheses

This section explains the hypothesised relationships of the proposed model in detail. These relationships were examined through path analysis using a standardised path coefficient (β), as presented in Figure 7-1 and as explained earlier in the previous sections. Table 7-14 provides a summary of the proposed hypotheses.

H1: Quality of services will positively affect an organisation's intention to adopt cloud computing.

The results show there was a positive significant direct effect between quality of services and an organisation's intention to adopt cloud technology. The standardised path coefficient (β) of quality of services is 0.56, with a critical ratio of 6.228, as shown in Table 7-9. This result means the path estimated between quality of services and an organisation's intention to adopt cloud computing is statistically significant at the $p < 0.001$ level, and strongly supports the hypothesis (H1) as proposed in the theoretical model. It can be concluded that quality of services has a positive influence on an organisation's intention to adopt cloud computing.

H1a: Organisation size will moderate the relationship between quality of services and an organisation's intention to adopt cloud computing.

Organisation size was found to have a positive interaction on the relationship between quality of services and intention to adopt cloud computing. The results showed that the effect of quality of services on SME's decision to employ cloud technology was stronger in SME than for large enterprises, β= 1.05 for SME, and β= 0.53 for large enterprises. Consequently, this result supported hypothesis H1a.

H2: Security concerns will negatively affect an organisation's intention to adopt cloud computing.

Security was found to have a direct impact on an organisation's intention to adopt cloud computing and the effect of this factor was negative. The standardised regression weight of security (β) is -0.17 and T-value of -2.163, as presented in Table 7-9. This result indicates that security has a significant negative impact on the adoption decisions of organisations (0.031 < 0.05). Therefore, the hypothesis H2 was confirmed.

H2a: Organisation size will moderate the relationship between security concerns and an organisation's intention to adopt cloud computing.

The effect of organisation size on the relationship between security and an organisation's intention to adopt cloud computing was negative. The stronger effect was in large enterprises β= -0.094, compared to SME, β= -0.504. However, the result suggests the relationship was significant (direct) in SME while there was an indirect effect in larger organisations, as shown in Table 7-12. So, the hypothesis H2a was accepted.

H3: Privacy concerns will negatively affect an organisation's intention to adopt cloud computing.

In this study, privacy was founded to have a significant effect on an organisation's intention to adopt cloud computing and this impact was negative. The value of the standardised path coefficient (β) of privacy was β= -0.139 and the T-value was -2.045. This result indicates the hypothesis H3 was supported.

H3a: Organisation size will moderate the relationship between privacy concerns and an organisation's intention to adopt cloud computing.

There was a negative interaction between organisation size and privacy in an enterprise's decision to utilise cloud services. Moreover, the effect was seen to be greater in large organisations, $\beta = -0.08$, compared to SME, $\beta = -0.22$. However, this effect was indirect in large organisations, whereas a significantly direct effect was found in SME. The hypothesis H3a was also accepted.

H4: Trust will positively affect an organisation's intention to adopt cloud computing.

The result indicated that the trust has a statistically significant effect on an organisation's intention to adopt cloud computing, and this effect was a positive. The value of standardised regression weight of T is 0.36, and Z-value is 3.675. The results suggest that the relationship between trust and intention to adopt cloud computing is statistically significant, at the $p < 0.001$ level. Thus, this result strongly supports hypothesis H4 as proposed in the model.

H4a: Organisation size will moderate the relationship between trust and an organisation's intention to adopt cloud computing.

A positive effect of size of organisation on the relationship between trust and intention to adopt cloud computing was found. The standardised regression weight for SME was $\beta = 0.25$ and for large enterprises was $\beta = 0.51$. So, the difference between SME and large enterprises was minor. On other hand, the impact of organisation size on the relationship between trust and intention to adopt cloud computing was indirect in SME while the relationship in large enterprises was direct. Therefore, this hypothesis was confirmed.

H5: Relative advantage will positively affect an organisation's intention to adopt cloud computing.

Unexpectedly, there was a negative indirect effect between relative advantage and an organisation's intention to employ cloud technology. The p-value of this factor was greater than 0.05, ($0.21 > 0.05$). Therefore, this result did not supported the hypothesis (H5).

H5a: Organisation size will moderate the relationship between relative advantage and an organisation's intention to adopt cloud computing.

The organisation's size was found to have a negative indirect influence on the relationship between relative advantage and intention to adopt cloud computing. The effect was stronger in larger sized organisations (β= -0.17) than in SME (β= -1.30). Consequently, this result supported hypothesis (H5a).

H6: Compatibility will positively affect an organisation's intention to adopt cloud computing.

As shown in Table 7-9, compatibility has a negative indirect impact on an organisation's decision to adopt cloud technology. The path estimated between compatibility and intention to adopt cloud computing was not significant at 0.05 level, (0.92 > 0.05). Hence, the result did not support the hypothesis (H6).

H6a: Organisation size will moderate the relationship between compatibility and an organisation's intention to adopt cloud computing.

There was an indirect relationship between organisation size and compatibility in their effect on the enterprises' intention to adopt cloud technology: a positive indirect interaction was found with SME, β= 0.77, and a negative interaction was found in large sized enterprises, β= -0.21. The effect was grater in SME compared to large sized organisations. Thus, hypothesis (H6a) was also confirmed.

H7: Trialability will positively affect an organisation's intention to adopt cloud computing.

The effect of trialability on an enterprise's intention to utilise cloud computing was indirect, and, the effect of this factor was negative, as shown in Table 7-9. The p-value of trialability was greater than 0.05. Therefore, the result did not support hypothesis H7.

H7a: Organisation size will moderate the relationship between trialability and an organisation's intention to adopt cloud computing.

The size of an organisation was found to have an indirect effect on the relationship between trialability and intention to adopt cloud computing. The effect was negative in SME (β= -0.61), whereas a positive interaction was found in large enterprises (β= 0.11). So, the impact was stronger in large enterprises than SME. Consequently, the result supported the hypothesis (H7a).

H8: Top management support will positively affect an organisation's intention to adopt cloud computing.

The result showed there was a negative indirect effect of top management support on an organisation's intent to adopt cloud services. As shown in Table 7-9, the p-value of this factor was 0.92, which is greater than 0.05. Therefore, this result did not support hypothesis H8.

H8a: Organisation size will moderate the relationship between top management support and an organisation's intention to adopt cloud computing.

There was a negative indirect interaction between size of organisation and top management support in influencing intention to adopt cloud computing. The standardised regression weight for SME was β= -0.06 and for large organisations it was β= -0.05. So no difference was observed between SME and large enterprises in this respect. Thus, hypothesis H8a was not accepted.

H9: Technology readiness will positively affect an organisation's intention to adopt cloud computing.

Technology readiness was found to have an indirect effect on an organisation’s intention to use cloud services. The p-value of technology readiness was greater than 0.05, (0.34 > 0.05). Therefore, the hypothesis H8 was not confirmed.

H9a: Organisation size will moderate the relationship between technology readiness and an organisation's intention to adopt cloud computing.

There was a positive interaction between size of organisations and technology readiness in influencing an organisation's intention to adopt cloud computing. As shown in Table 7-12, the effect was stronger with SME (β= 0.98) than large organisations (β= 0.04). Moreover, the effect was direct in SME, whereas an indirect impact was found in large sized enterprises. So, the result confirm this hypothesis (H9a).

H10: Compliance with regulations will positively affect an organisation's intention to adopt cloud computing.

The result indicates that the compliance with regulations has no direct impact on an organisation's decision to employ cloud technology. At level 0.05, the p-value of compliance with regulations was 0.68. This result did not supported hypothesis H10.

H10a: Organisation size will moderate the relationship between compliance with regulations and an organisation's intention to adopt cloud computing.

There was no direct interaction between organisation size and compliance with regulations in influencing an organisation's intention to adopt cloud computing. The effect was stronger in large organisations than SME: as shown in Table 7-12, the standardised regression weight for SME was β= 0.01 and for large organisations was β= 0.10. So, hypothesis H10a was supported.

H11: Physical location will positively affect an organisation's intention to adopt cloud computing.

The results suggest that physical location has an indirect effect on an organisation's intention to adopt cloud technology. As is clear from the result, the p-value of this factor was greater than 0.05, (0.81 > 0.05). Thus, this hypothesis (H11) was not confirmed.

H11a: Organisation size will moderate the relationship between physical location and an organisation's intention to adopt cloud computing.

There was indirect effect of the organisation’s size and physical location on its intention to adopt cloud computing. The SME showed a positive interaction, β= 0.47, while a negative

effect was found with large sized enterprises, β= -0.06. So, the effect was greater in SME. Consequently, the result support hypothesis (H11a).

H11.1: Physical location has direct impact on compliance with regulations.

Physical location was found to have a significant effect on compliance with regulations. The standardised regression weight of physical location is 0.73, and Z-value is 9.231. Thus, the path that links physical location with compliance with regulations was significant at the $p < 0.001$ level, which strongly supported this hypothesis (H11.1).

H11.1a: Organisation size will moderate relationship between physical location and compliance with regulations.

The results support this hypothesis. A positive direct effect of organisation size on the relationship between physical location and compliance with regulations was found. There was no substantial different between SME and large organisations, as shown in Table 7-12.

H11.2: Physical location has a direct impact on privacy.

The results indicate that the physical location has a significant (direct) effect on privacy. The regression weight of this relationship was 0.553 and critical ratio 7.857. This result showed that the relationship between physical location and privacy is statistically significant at the $p < 0.001$ level. Thus, the result strongly confirmed hypothesis (H11.2), as proposed in the theoretical model.

H11.2a: Organisation size will moderate relationship between physical location and privacy.

A positive interaction of organisation size with the relationship between physical location and privacy was found in this study. The path coefficient value for SME was β= 0.47, while for large organisations was β= 0.3. The difference between SME and large organisations was very minor, about 0.1, and this difference was not considered significant. However, hypothesis H11.2 was also supported.

H12: External support will positively affect an organisation's intention to adopt cloud computing.

External support has a negative indirect effect on an organisation’s decision to adopt cloud computing technologies. As shown in Table 7-9, the p-value of this factor was greater than 0.05, (0.37 > 0.05), so this hypothesis was not confirmed.

H12a: Organisation size will moderate the relationship between external support and an organisation's intention to adopt cloud computing.

The result suggests that there was a negative indirect interaction of size of organisations on the relationship between external support and an organisation's intention to adopt cloud computing. The effect was stronger in large enterprises β= -0.02 compared to SME β= -0.39. Thus, the result supported this hypothesis (H12a).

H13: The industry to which a firm belongs will have an impact on an organisation's intention to adopt cloud computing.

The industry to which a firm belongs has a positive indirect effect on an organisation's intention to adopt cloud services. The p-value of industry was 0.83, which is greater than 0.05. Therefore, this result did not support the hypothesis suggested in the model.

H13a: Organisation size will moderate the relationship between industry and an organisation's intention to adopt cloud computing.

There was an indirect effect of size of organisation on the relationship between industry and an organisation's intention to adopt cloud computing. The standardised regression weight for SME was β= 0.11, and β= 0.26 for large organisations. It is clear from the result there was no substantial difference between SME and large enterprises. However, this hypothesis was also confirmed.

H14: Culture will positively affect an organisation's intention to adopt cloud computing.

The data did not support this hypothesis. As shown in Table 7-9, the p-value of culture was greater than 0.05, (0.92 > 0.05), so this result suggests that the culture has an indirect negative effect on the organisation's intention to adopt cloud technology.

H14a: Organisation size will moderate the relationship between culture and an organisation's intention to adopt cloud computing.

The results indicate that organisation size has an indirect negative interaction with the relationship between culture and an enterprise's intention to adopt cloud computing. There was no difference between SME and large enterprises: as shown in Table 7-12, the value for SME was β= -0.1 and for large enterprises it was β= -0.1. Hence, the result did not confirm this hypothesis, H14a.

Table 7-14 Summary of hypotheses.

Hypotheses	**Result**
H1: Quality of services will positively affect an organisation's intention to adopt cloud computing.	Supported
H1a: Organisation size will moderate the relationship between quality of services and an organisation's intention to adopt cloud computing.	Supported, the effect was stronger in SME
H2: Security concerns will negatively affect an organisation's intention to adopt cloud computing.	Supported
H2a: Organisation size will moderate the relationship between security concerns and an organisation's intention to adopt cloud computing.	Supported
H3: Privacy concerns will negatively affect an organisation's intention to adopt cloud computing.	Supported
H3a: Organisation size will moderate the relationship between privacy concerns and an organisation's intention to adopt cloud computing.	Supported
H4: Trust will positively affect an organisation's intention to adopt cloud computing.	Supported
H4a: Organisation size will moderate the relationship between trust and an organisation's intention to adopt cloud computing.	Supported
H5: Relative advantage will positively affect an organisation's intention to adopt cloud computing.	Not supported, the effect was indirect, (0.21 > 0.05)

Hypotheses	Result
H5a: Organisation size will moderate the relationship between relative advantage and an organisation's intention to adopt cloud computing.	Supported
H6: Compatibility will positively affect an organisation's intention to adopt cloud computing.	Not supported, there was a negative indirect effect, (0.92 > 0.05)
H6a: Organisation size will moderate the relationship between compatibility and an organisation's intention to adopt cloud computing.	Supported
H7: Trialability will positively affect an organisation's intention to adopt cloud computing.	Not supported, there was a negative indirect effect, (0.71 > 0.05)
H7a: Organisation size will moderate the relationship between trialability and an organisation's intention to adopt cloud computing.	Supported
H8: Top management support will positively affect an organisation's intention to adopt cloud computing.	Not supported, there was a negative indirect effect, (0.92 >0.05)
H8a: Organisation size will moderate the relationship between top management support and an organisation's intention to adopt cloud computing.	Not supported
H9: Technology readiness will positively affect an organisation's intention to adopt cloud computing.	Not supported, there is no direct effect, (0.34 > 0.05)
H9a: Organisation size will moderate the relationship between technology readiness and an organisation's intention to adopt cloud computing.	Supported
H10: Compliance with regulations will positively affect an organisation's intention to adopt cloud computing.	Not supported, the effect was indirect, (0.68 > 0.05)
H10a: Organisation size will moderate the relationship between compliance with regulations and an organisation's intention to adopt cloud computing.	Supported
H11: Physical location will positively affect an organisation's intention to adopt cloud computing.	Not supported, the effect was indirect, (0.81 > 0.05)
H11a: Organisation size will moderate the relationship between physical location and an organisation's intention to adopt cloud computing.	Supported
H11.1: Physical location has direct impact on compliance with regulations.	Supported
H11.1a: Organisation size will moderate relationship between physical location and compliance with regulations.	Supported, there was no significant difference between SME and large organisations

Hypotheses	Result
H11.2: Physical location has a direct impact on privacy.	Supported
H11.2a: Organisation size will moderate relationship between physical location and privacy.	Supported
H12: External support will positively affect an organisation's intention to adopt cloud computing.	Not supported, there was a negative indirect effect, (0.37 >0.05)
H12a: Organisation size will moderate the relationship between external support and an organisation's intention to adopt cloud computing.	Supported
H13: The industry to which a firm belongs will have an impact on an organisation's intention to adopt cloud computing.	Not supported, the effect was indirect, (0.83 > 0.05)
H13a: Organisation size will moderate the relationship between industry and organisation's intention to adopt cloud computing.	Supported
H14: Culture will positively affect an organisation's intention to adopt cloud computing.	Not supported, the effect was indirect, (0.92 > 0.05)
H14a: Organisation size will moderate the relationship between culture and an organisation's intention to adopt cloud computing.	Not supported

7.4 Summary

This chapter presented the findings of the survey used to test the proposed model. In this study, 300 cases were used in the analysis after excluding the cases with missing values that exceeded the accepted rate. The proposed model was analysed through two stages in the SEM: the measurement model and the structural model. In the first stage (measurement level analysis), the composite reliability and construct validity (convergent, discriminant and nomological validity) were used to verify measurements used in this study. The results showed that the privacy, trust and compatibility compliance with the regulations and culture had lower values of validity. However, the validity of these constructs were improved by excluding items that had low values of factor loading (less than 0.5).

In the second stage (structural level analysis), the most recommended GoF indices were reported in this study to assess the GoF; the results confirmed that the proposed model fits well with the collected data. Furthermore, the relationships among the latent variables were

analysed. The results showed that the quality of service, security, privacy and trust directly affected an organisation's intent to adopt cloud services in Saudi Arabia. However, the effect of security and privacy on the adoption decision were negative. In addition, the physical location directly impacted the compliance with regulation and privacy; these relationships were moderated by the organisations' size. Moreover, the organisation size positively interacted with the relationship between the quality of services and an enterprise's intent to adopt cloud technology. In contrast, relative advantage, compatibility, trialability, top management support, external support and culture were found to have a negative, indirect effect on an organisation's intent to employ cloud technology. The results suggested a positive, indirect relationship between these variables (technology readiness, compliance with regulations, physical location and industry) and an organisation's intent to employ cloud technology. Finally, this chapter concluded with an assessment of the proposed hypothesis. The findings of this study will be discussed in detail in the next chapter.

Chapter 8: Discussion

This chapter discusses the findings of the evaluation study. It explains the results of the questionnaire conducted with 300 IT staff in the private sector in Saudi Arabia. It discusses in detail the effect of technological factors, organisational, environmental and social factors on an organisation's decision to adopt cloud services in SME and large enterprises, together with the potential reasons for each finding. Furthermore, this chapter presents and discusses the differences between the organisations which were using the cloud and those that were non-adopters. Finally, it provides a summary of the research questions that have been answered.

8.1 Technological Factors

This section discusses the effect of factors related to the characteristics of the cloud technology. These factors are quality of service, security, privacy, trust, relative advantage, compatibility, and trialability.

8.1.1 Quality of Service

Cloud computing provides services to end users at any time and everywhere. Therefore, ensuring a high level of service to end users will increase the chance of adopting the technology (Rehman et al., 2012). The results reveal that the quality of services has a statistically significant impact on an organisation’s decision to employ cloud technology. The relationship between this factor and an organisation's intention to adopt cloud computing was positive ($\beta = 0.564$). This finding is consistent with former studies (Güner and Sneiders, 2014; Alsanea and Barth, 2015).

Furthermore, it was found that the quality of services is one of the factors that drive organisations to utilise cloud services, as the effect of this factor on the organisations that had already adopted cloud technology was slightly stronger than that for non-adopters: $\beta = 0.77$ for adopters, and $\beta = 0.49$ for non-adopters. In this study, it was found that the level of effect differed according to the organisation’s size: the relationship between quality service and an organisation’s decision was stronger in SME than in large enterprises. One potential

explanation of this result is that the large organisations have the necessary skills, resources and experience to overcome any downtime or failure in services more easily than SME, and moreover, their ability to accept risk with new technology has been found to be greater than that of SME (Premkumar and Roberts, 1999; Hayes, 2008; Pan and Jang, 2008). Overall, the results of this study imply that ensuring quality of services in the SLA between cloud providers and organisations is an important step to increase the adoption of cloud technology.

8.1.2 Security

Although security solutions and techniques have been enhanced to ensure that the cloud is a secure environment (Pancholi and Patel, 2016; Tang et al., 2016), security concerns were found among the barriers that inhibit companies from adopting cloud technology in the private sector in Saudi Arabia. This result is in agreement with past studies (Lian et al., 2014; Lal and Bharadwaj, 2016), which found that concern about security is one of the main reasons that prevent organisations from adopting cloud technology.

The results showed that both sizes of organisations were still concerned about security. However, this concern was greater in large organisations compared to SME: as shown in Chapter 7 (Table 7-12), security concerns had a direct negative impact on an organisation's decision to adopt the cloud in SME, while in large enterprises there was an indirect effect. A possible explanation of this finding is that large sized organisations have more users, stakeholders, customers and competitors in the market, compared to smaller sized organisations. Therefore, their concern about their reputation in the market is higher than that of other organisations. Consequently, any security issues could lead them to high risks and possible loss of their reputation in the market.

Furthermore, it was found that the effect of this factor in organisations that already utilised cloud services was indirect, while for non-adopters there was a direct impact. However, issue of security still has a negative influence in adopter companies. This implies the adopters also still feel that this technology is not fully secure. It can be concluded that security is one of the obstacles to cloud adoption in this country.

8.1.3 Privacy

Similarly to security, the issue of privacy was found to have a significant negative impact on adoption of cloud computing in the Saudi private sector. The participants stressed their concerns about personal data and the concern that their organisation's information in the cloud could be exposed to other parties without their consent. The results show that the level of concern regarding privacy in the large organisations differed from that in the SME. As shown in Chapter 7 (Table7-12), the issue of privacy has a stronger effect in large enterprises, β= -0.08, than in SME, β= -0.22. However, the impact of this factor was indirect in large organisations, whereas a direct impact was found in SME.

Furthermore, the results indicate that the concern about privacy does not just affect the non-adopter companies. In this study, the organisations that already utilised cloud services still had fears about the privacy issue. In fact, this result may explain why the adopter companies in this study preferred to utilise private cloud services rather than other types. Overall, the result of this study implies that concern about privacy is one of the barriers against the adoption of cloud technology. The findings of this study are consistent with a former study (Alateyah et al., 2013), which found that privacy concerns affected the citizens' intention to adopt online services (e-government) in Saudi Arabia. Also, it is in line with another study (Takabi et al., 2010), which stated the privacy as one of the challenges that facing cloud adoption.

8.1.4 Trust

In this study, trust was found to be a significant factor which had a positive influence on an organisation's decision to use cloud services. The finding of this present study is in line with prior studies, which confirmed that trust has a direct impact adoption of new technology, as well as being one of the major requirements for using online services (Bélanger, 2002; Carter and Bélanger, 2005; Alateyah et al., 2014).

Further, it was found that the relationship between this factor and an enterprise's intention to adopt was slightly different between SME (β= 0.25) and large enterprises (β= 0.51), as shown in Table 7-12 (Chapter 7): the effect of trust on an organisation's intention to adopt cloud computing was indirect in SME, whereas a direct impact was found in large enterprises.

In investigating the impact of trust across adopter and non-adopter companies, it was found that there was no difference between the organisations that were already using cloud services and non-adopters. However, this factor had a significant (direct) influence in non-adopters while an indirect relationship was found in adopter companies. The findings of this study mean that the trust is one of the factors that drive the adoption of the cloud in the Saudi private sector. Thus, trust needs to exist between all parties to increase adoption of cloud services.

8.1.5 Relative Advantage

Organisations tend to adopt new technology, when they perceive significant benefits and value from that technology (Lee, 2004; Wang et al., 2010). The relative advantage of utilising the cloud is that it will help an organisations to accomplish tasks more quickly, reduce costs, and increase productivity and flexibility in organisations (Armbrust et al., 2010). The results of this study revealed that the relative advantage has a negative indirect relationship with adoption of the cloud. This result disagrees with findings of former studies (Alshamaila et al., 2013; Borgman et al., 2013; Oliveira et al., 2014), which have found relative advantage drives companies to employ the cloud. However, this finding is consistent with another study (Low et al., 2011), which reported that this factor had a negative effect on cloud adoption in high-tech industry in Taiwan, as well as with findings of other research (Gutierrez et.al, 2015). The finding of this study suggests that some organisations in Saudi Arabia did not yet realise the benefits of implementing cloud computing. One possible explanation of this result is that there may be lack of understanding and awareness of the advantages of this technology or that the benefits are not obvious to the organisations. Another possible reason is that the cost of this technology is on an annual basis and the charging mechanism unclear. This issue was also mentioned by a number of experts during the interviews (Chapter 5) as one of reasons behind their decision not to adopt cloud services. The participants stated that the cost would be high or, in the best cases, similar to the cost of maintaining the data in-house.

Further, the result indicated that the larger sized organisations and SME differed in their beliefs about the benefits of cloud technology. The negative impact was greater in larger sized organisations (β= -0.17) compared to that in SME (β= -1.30). It was also found that the

effect of this factor was stronger for adopters (β= 0.63), than non-adopters (β= -0.08). On the whole, this finding confirmed the previous findings from the interview in Chapter 5, that the companies already utilising the cloud were aware of the advantage of this technology and these benefits had encouraged them to use it. In conclusion, it seems that, in order to increase implementation of this technology, the level of benefit that organisations receive from the cloud should be made clear to them.

8.1.6 Compatibility

Businesses are more likely to adopt new technology, when it is compatible with their needs and existing work (Thong, 1999; Rogers, 2003). In this study, compatibility was found to have an indirect effect on an organisation's decision to adopt cloud services. The relationship between this factor and an organisation's intention to adopt cloud computing was negative. One possible reason for this result was that the cloud did not fit with existing work practices in organisations. The impact of this variable also differed according to the organisation's size. The effect was greater in SME than in large sized enterprises. This result is in line with former research (Low et al., 2011; Alshamaila et al., 2013; Borgman et al., 2013; Gutierrez et.al, 2015), which found that concerns about compatibility inhibited the cloud adoption.

Moreover, the results showed that the effect of this factor in adopter organisations was positive and stronger than in non-adopters. A possible explanation for this finding is that there is relationship between compatibility and the nature of the business. As shown in Table 7-11, compatibility showed a correlation with industry type (0.63). This relationship was also confirmed by the fact that most of the participants' in this study who were working in companies which had already adopted cloud computing were from the technology sector, whereas those working in non-adopter companies were from the manufacturing and petrochemical sectors. Moreover, this finding is consistent with an earlier study (Oliveira et al., 2014), which showed that the effect of this factor was insignificant in the manufacturing sector but significant in the service sector in Portugal. This implies the cloud services are more compatible with organisations that depend on Internet business operations.

8.1.7 Trialability

Trialability refers to the ability of organisations to try out cloud services on a limited basis before making an adoption decision. Similarly, lack of trialability was found to be one of the

barriers towards cloud adoption. The result showed that the influence of this factor on an organisations decision was indirect. This factor also played a negative role in decisions about cloud adoption in the private sector in Saudi Arabia. However, the level of effect of this factor varied based on the size of organisations, as shown in Chapter 7 (Table 7-12 and Table 7-13). This factor had a greater effect and a positive interaction with large enterprises as well as with adopter companies, whereas the interaction with SME and non-adopters was negative. This result implies that trialability was one of the factors that had motivated the organisations that had already adopted the cloud, but lack of trialability of the services required was a factor in non-adopter companies. The finding of this research is supported by a former study (Alshamaila et al., 2013), which also found that trialability had an indirect effect on adoption of cloud technology in SME in the northeast of England, and is in agreement with other research such as that by Lin and Chen (2012). One possible explanation of this finding is that there is relationship between trialability and the level of support that organisations received from the cloud provider. Trialability was found to be highly correlated with external support (0.696), as shown in Table 7-11. It also has a correlation with compatibility (0.651) and relative advantage (0.549) consecutively. It can be concluded that to encourage cloud adoption in Saudi Arabia, more effort must be made on the cloud service providers' side to offer the opportunity for organisations to try out cloud services for a sufficient period of time and to assess how this technology will bring significant value to their business. Moreover, this would also enable them to see if this technology is compatible with their work style.

8.2 Organisational Factors

Organisational factors have a significant influence in adoption of new technology (Ramdani, 2008). The findings regarding the organisational context are discussed in this section. Two organisational factors were studied in this research: top management support and technology readiness.

8.2.1 Top Management Support

Support from top management is essential and considered an important element in the adoption of new technologies in organisations (Ramdani and Kawalek, 2009). In this study, top management support was found to have an indirect effect on an organisation's intention.

Moreover, the present findings show that the relationship between this factor and an organisation's intention to adopt cloud computing was negative (β= -0.006). These results mean there is a lack of support from top management side in some organisations for adoption cloud technology. This result is in line with previous studies in this field (Alshamaila et al., 2013; Gutierrez et al., 2015), which found that top management had indirect impact towards cloud adoption among enterprises in the UK. However, this is inconsistent with other studies (Abdollahzadehgan et al., 2013; Borgman et al., 2013; Lian et al., 2014; Lal and Bharadwaj, 2016).

Furthermore, the result showed there was no difference between SME and large enterprises in the impact of top management on an organisation's intention to adopt cloud. Thus, the organisation's size had no effect on the relationship.

On the other hand, the finding of this research indicated that top management support has a positive effect in adopter organisations, whereas a negative interaction was found in non-adopter companies. This means this factor plays a positive role in adopter companies but some organisations still suffer from lack of support by top management for adoption of new technology. Support from top management is essential to increase the adoption of cloud computing in Saudi Arabia, because the adoption decision does not only come from IT staff. Thus, the adoption of the cloud requires support from both top management and decision-makers in the IT department.

8.2.2 Technology Readiness

Organisations that have a robust technical infrastructure (e.g., high bandwidth) and necessary technical skills are more likely to employ a new technology (Parasuraman, 2000; Zhu et al., 2006). Prior studies found that technology readiness has a primary role in adoption of cloud technology (Gutierrez et al., 2015; Oliveira et al., 2014). In this study technology readiness was found to have an indirect impact on cloud adoption. However, this factor has a significant (direct) influence in SME as well as with non-adopter companies.

Moreover, the results indicated that there was an interaction between the size of organisations and the relationship between technology readiness and an organisation's intention to adopt cloud computing. The influence of technology readiness was greater for

SME than for large organisations. As shown in Table 7-12 (Chapter 7), this variable had a significant (direct) effect in SME, but an indirect impact was found in large sized enterprises. This result means the effect of this factor on an organisation's intention to adopt cloud computing depends on the organisation's size.

In addition, there was a difference between adopter and non-adopter companies in terms of the impact of technology readiness. The results showed that technology readiness had a negative significant effect in non-adopter companies, whereas the impact of this factor was indirect in organisations that had already adopted the cloud. This finding implies that this factor still impeded some organisations from employing cloud services. One potential explanation of this present finding is that the technical infrastructure in Saudi Arabia is still at the development stage. The Internet connectivity is still unstable, in addition to the cost of Internet services being very high compared to developed countries. Another explanation is that some organisations still have limited technical skills in using cloud computing technology. Overall, this factor plays an important role in an organisation's decision to utilise cloud services. The access to cloud services is based on the availability of the Internet. Therefore, to increase adoption of online services in Saudi Arabia an effort must be made to address Internet infrastructure (i.e., bandwidth and speed). In addition, having the necessary skills within the organisations would encourage adoption of this technology.

8.3 Environmental Factors

The effect of environmental factors on adoption of cloud services is discussed in this section. The environmental factors included in this study are compliance with regulations, physical location, external support, and type of industry.

8.3.1 Compliance with Regulations

In terms of compliance with regulations, the finding shows that this factor had an indirect effect on cloud adoption. This result seems to be consistent with former studies (Borgman et al., 2013; Nkhoma and Dang, 2013), which concluded that this factor had no direct impact on adoption of this technology.

Regarding the impact of size of organisation, it was found that the relationship between this factor and an organisation's intention to employ cloud technology was stronger in large enterprises than in SME. The standardised regression weight for SME was β= 0.01, and β= 0.10 for large enterprises.

However, this factor has a greater impact and a positive interaction with adopter companies, whereas a negative impact was found in organisations that have not yet employed cloud services. This result implies that there is still deep concern regarding compliance issues in relation to the use of the cloud in the private sector in Saudi Arabia. A possible explanation for this finding is that there is a lack of rules or governmental regulations that support organisations during events that may face them in using the cloud. Therefore, to encourage adoption it is necessary that the cloud computing regulations comply with Saudi Arabian law as well as with industrial rules. In addition, support from the government side is needed to introduce suitable regulations or to update their existing regulations to comply with the requirements of the cloud.

8.3.2 Physical Location

To the best of the author's knowledge, this factor has not yet been included in former studies as a main factor when examining factors that impact on cloud adoption at organisational level. The results in Chapter 7 indicated that the physical location had an indirect influence on an organisation's intention to utilise cloud services. Moreover, it was found that the organisation's size affected the relationship between physical location and an organisation's intention to adopt cloud computing. This factor played a negative role towards adoption in large enterprises, whereas there was a positive interaction in SME. These findings imply that large enterprises have more concerns regarding the location of data centres in which the cloud provider will store their organisations' data. Actually, such concerns arise from the fear that some cloud providers store the organisations' data in other countries without informing the end users and that this could lead to compliance issues and privacy concerns.

Moreover, the result showed there was no difference between the organisations that already used cloud and non-adopters in the relationship between physical location and the enterprise's decision.

On the other hand, this study provides evidence that the physical location has a significant (direct) effect on compliance with regulations as well as upon privacy. There was no substantial difference between SME and large enterprises in the impact of physical location on compliance with regulations and on privacy. However, the finding of this research shows that the influence of this factor on compliance with regulations as well on privacy was slightly stronger in non-adopters than adopters. In addition, it was found that the physical location highly correlated with security (0.546), as shown in Table 7-11. Overall, the result of this study implies that the organisations preferred the location of the data-centre to be inside the country and subject to Saudi Arabian laws and legislation. Therefore, it is necessary the cloud providers take the data centres' location into consideration in order to address the compliance issue and the privacy and security concerns of organisations.

8.3.3 External Support

This factor emerged from interviews conducted previously with IT experts. External support refers to the support from the cloud provider's side to meet an organisation's requirements. The finding showed this factor has a negative indirect influence on cloud adoption. This result is supported by another study (Alshamaila et al., 2013), which found that the factor was negatively associated with adoption in SME. However, this is in disagreement with other prior studies (DeLone, 1981; Scupola, 2003).

Moreover, it was found that the impact of external support differed slightly based on size of organisation. As shown in Chapter 7 (Table 7-12), the negative effect was slightly greater in large enterprises (β= -0.02) than SME (β= -0.39). However, there was no difference between adopters and non-adopters in the influence of this factor on an enterprise's decision. One possible explanation for this finding is that the cloud providers may be focusing on selling cloud services rather than supporting the organisations' needs. Another explanation for this is that, to the best of the author's knowledge, there is a lack of cloud providers in Saudi Arabia, and this could explain why the adoption of this technology still low among enterprises. The result of this research implies more effort on the cloud providers' side is needed pre and post the adoption, to meet the organisations' requirements.

8.3.4 Industry

The findings indicated that the nature of the business had a positive indirect effect on adoption of cloud services in the private sector in Saudi Arabia. This finding is in agreement with a previous study (Thong 1999), which stated the relationship between the industry in which a firm operates its business and adoption of IT innovation was not significant as well as with another study (Alshamaila et al., 2013), which also found this factor had an indirect impact on SME's decisions to employ cloud technology. This study found there was no substantial difference between SME and large enterprises, but the impact of this factor on an organisation's intention was greater in non-adopter companies than in adopters.

However, this finding does not mean the nature of the business did not influence cloud adoption: as shown in Table 7-1 (Chapter 7), most of the participants' organisations which had already adopted cloud services belonged to the technology sector, whereas non-adopters were from the manufacturing and petrochemical sectors. Thus, this implies the cloud is more suitable for sectors that depend on IT technology. One plausible explanation for this conflict is that the largest group of respondents in this study were working in the manufacturing, petrochemical and engineering sectors, so it may be that the cloud did not fit their working practices and that their requirements for Internet-based services were limited. As mentioned earlier, the business nature of organisations showed a correlation with compatibility. It can be concluded the industry type still plays an important role in deciding to adopt cloud services.

8.4 Social Factor

The social context is also an important aspect that should be taken into consideration. This section discusses the findings regarding the impact of culture on cloud adoption in Saudi Arabia.

8.4.1 Culture

This factor also emerged from the interviews carried out with IT experts in the exploratory study. Surprisingly, culture was found to inhibit cloud adoption. Culture was observed to have a negative indirect relationship with the organisation's decision to employ the cloud. This finding was supported by a former study (Alateyah et al., 2014), which found that

culture is one of the major challenges facing adoption of e- Government in Saudi Arabia; another study, conducted in Kuwait (Alawadhi and Morris, 2008), also found that culture influenced the use of online services. Further, the result of the present study shows that, in terms of the negative impact of culture on an enterprise's intention to adopt cloud computing, there was no difference between SME and large organisations. However, the negative relationship was stronger in non-adopters than in adopter companies.

Actually, several studies have found that culture is one of barriers facing adoption of new technology and use of online services (Hwang et al., 2004; Schneider, 2010). One possible explanation of this finding is that there is lack of awareness and knowledge of the cloud technology and how it works. In fact, government organisations in Saudi Arabia face several problems related to acceptance of new technology and to the best of the author's knowledge, most people in Saudi society prefer to contact government via the traditional methods rather than online services. So, increasing awareness activities through media, particularly social networks, may encourage acceptance of new services in Saudi society. Another potential explanation is the relationship between culture and trust, as almost half (49.7%) of respondents in this study agreed that they would use cloud technology if the cloud provider was based in Saudi Arabia. As indicated in Table 7-11, culture has a correlation with trust (0.420). This relation should be further investigated in future research.

8.5 Research Questions

Various methods were utilised during the exploratory and evaluative studies to answer the following questions:

Q1. What are the influential factors in an organisation's decision to adopt cloud computing technology in the private sector in Saudi Arabia?

Q2. What is the relationship between the factors and an organisation's intention to adopt cloud services?

Q3. Does the size of an organisation moderate the relationships between the factors and an organisation's intention to adopt cloud services?

Q4. What is the difference between adopter and non-adopter companies in terms of the effect of these factors?

The research question 1 was answered during the exploratory study, while the remaining questions were addressed in the evaluation stage. A summary of the answers is presented in the sections below.

Q1. What are the influential factors in a Saudi Arabian organisation's decision to adopt cloud computing technology?

The purpose of this question was to investigate factors that influence an organisation's decision to use cloud services in Saudi Arabia. The question was answered in three stages. First the proposed factors in the initial model were identified through a process described in Chapter 2, from the literature review along with other factors that have not yet been investigated as main factors that may have an effect on cloud adoption in enterprises. This study utilised both qualitative and quantitative methods (i.e., a mixed method). Semi-structured interviews were carried out with 20 IT experts in different organisations in Saudi Arabia, in order to assess the importance of the proposed factors in the cloud adoption model and to explore more factors from the experts' viewpoints. The findings from the interviews that have been presented in Chapter 5 indicate that all the proposed factors are of statistically significant importance, except the competitive pressure factor and the trading partner pressure factor. However, the findings from previous studies indicated that the competitive pressure factor has significant impact on an organisation's decision to adopt cloud computing. Therefore, this factor was kept in the proposed model at this stage and only the trading partner pressure factor was removed. In the next stage, an online questionnaire was carried out with thirty IT staff in different private organisations in Saudi Arabia. The aim of the questionnaire was to confirm the proposed factors in the cloud adoption model, as well as other factors that were identified from the interviews (trialability, external support, industry, and culture). The results of the questionnaire that have been presented in Chapter 5 show that there are fifteen factors which have significant impact on an organisation's intention to adopt cloud services in Saudi Arabia. These factors are quality of service, security, privacy, trust, relative advantage, compatibility, trialability, top management support, organisation size, technological readiness, compliance with regulations, physical location, external support,

industry, and culture. In fact, complexity and competitive pressure were not found to be the significant factors in this study, so these factors have been excluded from the model.

Q2. What is the relationships between the factors and an organisation's intention to adopt cloud services?

The purpose of this question was to explore factors that encourage or impede cloud adoption in private sector in Saudi Arabia, and also to measure the strength of the relationship among the independent and dependent variables. The question was answered by testing the proposed model (Figure 5-1) in Chapter 5 quantitatively. Thus, the final questionnaire was used to answer this question. The questionnaires were conducted with 300 IT staff in private organisations in Saudi Arabia. The results confirmed that the proposed model fits well with the observed data. The findings of this study showed that the quality of service, security, privacy and trust have a direct impact on an organisation's intention. However, the security and privacy concerns still limit cloud adoption in Saudi Arabia. Furthermore, six factors were found to have a negative, indirect impact on the adoption of the cloud. These factors are relative advantage, compatibility, trialability, top management support, external support, and culture. This study also showed that the physical location had a significant direct influence on the factors compliance with regulation and privacy. Table 8-1 provides a summary of these relationships and their priority, which has been discussed in detail in former sections.

Table 8-1 A summary of the relationships between the factors and an organisation's intent to adopt cloud.

	Hypothesised Path	**β**	**P**	**Impact**	**Priority**
H1 (+)	QS → IAC	0.564	<0.001	Positive direct impact	High priority
H2 (-)	S → IAC	-.174	0.031	Negative direct impact	Mid-priority
H3 (-)	P → IAC	-0.139	0.041	Negative direct impact	Mid-priority
H4 (+)	T → IAC	0.363	<0.001	Positive direct impact	High priority
H5 (+)	RA → IAC	-.135	0.217	Negative indirect impact	Low priority
H6 (+)	C → IAC	-.017	0.925	Negative indirect impact	Low priority
H7 (+)	TA → IAC	-.031	0.714	Negative indirect impact	Low priority
H8 (+)	TMS → IAC	-.006	0.928	Negative indirect impact	Low priority
H9 (+)	TR → IAC	0.118	0.346	Positive indirect impact	Low priority

	Hypothesised Path	β	P	Impact	Priority
H10 (+)	CR → IAC	0.034	0.687	Positive indirect impact	Low priority
H11 (+)	PL → IAC	0.043	0.817	Positive indirect impact	Low priority
H11.1	PL → CR	0.733	<0.001	Positive direct impact	High priority
H11.2	PL → P	0.553	<0.001	Positive direct impact	High priority
H12 (+)	ES → IAC	-.078	0.379	Negative indirect impact	Low priority
H13	I → IAC	0.020	0.832	Positive indirect impact	Low priority
H14 (+)	CU → IAC	-.010	0.920	Negative indirect impact	Low priority

Q3. Does the size of an organisation moderate the relationships between the factors and an organisation's intention to adopt cloud services?

The aim of this question was to assess the impact of organisation size on these relationships, to see if the effect differed according to organisation size. This question was also answered through the questionnaire in the evaluation study. The results showed that there was a significant interaction between organisation size and quality of service in an enterprise's intention to utilise cloud services. The size of the organisation also had a significant interaction with the relationship between physical location and compliance with regulation, as well as with privacy. The finding of this study also showed that in SME, security, privacy and technology readiness had a significant direct impact on an organisation's intention to adopt cloud services, whereas in larger-sized enterprises, the effect of these factors was indirect. However, security and privacy still concerned all sizes of organisations. Furthermore, the level of trust had a direct interaction on cloud adoption in large enterprises, while indirect interaction was found in SME. The findings regarding the effect of the size of an organisation on the relationships between the factors and the enterprise's intention have been discussed in detail in the previous section and Table 8-2 provides a summary of these findings.

Table 8-2 A summary of the impact of organisation size on the relationships between factors and adoption decision.

Hypothesis Path		Impact	SME vs. Large
H1a	QS →I AC	Positive impact- direct in all sizes	The effect was greater in SME than large organisations
H2a	S→ IAC	Negative impact- direct in SME	The negative impact was greater in large organisations, compared to SME.

Hypothesis Path		Impact	SMEs vs. Large
H3a	P→ IAC	Negative impact- direct in SME	The negative effect was greater in large organisations than SME
H4a	T→ IAC	Positive impact- direct in large organisations	No substantial difference between SME and large enterprises
H5a	RA→ IAC	Negative impact	The negative impact was greater in large organisations than in SME
H6a	C→ IAC	The positive impact was in SME while there was a negative effect in large organisations	The effect was greater in SME than in large sized enterprises
H7a	TA→ IAC	The negative influence was in SME while there was a positive effect in large organisations	The impact was greater in large organisations than in SME
H8a	TMS→ IAC	Negative impact	No difference between SME and large sized enterprises
H9a	TR→ IAC	Positive impact- direct in SME	The effect was greater in SME
H10a	CR→ IAC	Positive impact	The effect was greater in large enterprises than SME
H11a	PL→ IAC	A positive effect in SME whereas, a negative impact in large enterprises	The impact was greater in SME
H11.1a	PL→ CR	Positive impact- direct in all sizes	No significant difference between SME and large organisations.
H11.2a	PL→ P	Positive impact- direct in all sizes	No substantially different impact on the relationship
H12a	ES→ IAC	Negative impact	The negative impact was greater in large organisations than in SME
H13a	I→ IAC	Positive impact	No significant difference between SME and large enterprises
H14a	CU→ IAC	Negative impact	No different influence on the relationship

Q4. What is the difference between adopter and non-adopter companies in terms of the effect of these factors?

Although the adoption of cloud technology in Saudi Arabia is still low, this research has investigated the differences between companies that had already adopted cloud services and non-adopters. As shown in Figure 7-1 (Chapter 7), 78% of respondents in this study reported that their organisations had not yet adopted cloud technology and only 22% were working in organisations that already employed cloud services. The final questionnaire was also used to answer this question. The results showed some differences between adopter and non-adopters in the effect of these factors on their decisions. The factors of security, privacy, trust and technology readiness had a direct effect on an organisation's decision to employ cloud technology, whereas the impact of these factors was indirect in adopter companies. However, the findings of this study show that the adopter companies were also still concerned about security and privacy in the cloud. Furthermore, in all groups, the quality of

services directly impacted cloud adoption, but the effect was slightly more in adopters than non-adopters. In addition, the results show that the physical location had a direct effect on compliance with regulation and privacy, in both groups. However, these relationships were slightly stronger in non-adopters compared to organisations that utilised the cloud. Overall, these variations were also discussed in detail previously and Table 8-3 summarises the differences between adopter and non-adopter companies.

Table 8-3 A summary of the difference between adopters and non-adopter enterprises.

Hypothesis Path		**Impact**	**Adopters vs. Non-adopters**
H1	QS →I AC	Positive effect	The effect was slightly stronger in adopters
H2	S→ IAC	Negative effect	The effect was stronger in adopters compared to non- adopters
H3	P→ IAC	Negative effect	The impact was greater in adopters
H4	T→ IAC	Positive effect	No difference between them
H5	RA→ IAC	There was a negative impact in non-adopters while there was a positive effect in adopters	The effect was stronger in adopters than non-adopters
H6	C→ IAC	The positive influence was in the adopters, whereas there was a negative effect in non-adopters	The impact was greater in adopters compared to non- adopters
H7	TA→ IAC	The negative effect was in non-adopters while there was a positive impact in adopters	The impact was greater in adopters than non-adopters
H8	TMS→ IAC	The negative influence was in non-adopters while there was a positive effect in adopters	The effect was stronger in adopters than non-adopters
H9	TR→ IAC	A positive influence was in adopters, whereas there was a negative impact in non-adopters	The impact was greater in adopters than non-adopters
H10	CR→ IAC	The negative effect was in non-adopters while there was a positive impact in adopters	The impact was greater in adopters than non-adopters
H11	PL→ IAC	Positive effect	No difference between them
H11.1	PL→ CR	Positive effect	The effect was slightly stronger in non-adopters
H11.2	PL→ P	Positive effect	The effect was slightly greater in non- adopters than adopters
H12	ES→ IAC	Negative effect	No difference between them
H13	I→ IAC	Positive effect	The effect was grater in non-adopters
H14a	CU→ IAC	Negative effect	The negative impact was greater in non-adopters

8.6 Summary

This chapter has discussed the key findings of this research, including the relationships between the factors and an organisation's decision to employ cloud technology, as well as the effect of the size of organisations on these relationships. The findings showed that there were four factors which had a direct effect on attitudes towards cloud adoption. These factors were quality of service, security, privacy and trust. However, the security and privacy concerns negatively influenced adoption of this technology. Furthermore, this study has shown that relative advantage, compatibility, trialability, top management support, external support, and culture also had an indirect negative influence. This research also confirmed that the physical location had a significant impact in relation to compliance with regulation and privacy. The chapter also presented and discussed in detail the differences found between the adopters and non-adopters in relation to all these factors. Finally, the chapter ended with a discussion of the research questions that have been answered. In the next chapter, conclusions will be drawn from the findings and future research directions will be suggested.

Chapter 9: Conclusions and Future Work

This chapter provides an overview of the research that been conducted in Saudi Arabia. It also outlines and discusses the theoretical contributions and practical contributions of this research in detail. Finally, this chapter points out and suggests directions for future research.

9.1 Research Overview

Cloud computing is the emerging paradigm of delivering IT services to consumers as a utility service over the Internet. The study started by providing an overview of cloud computing, in order to understand the basic characteristics of the cloud. The great benefit of cloud computing is that the cloud offers resources to multiple users at any time in a dynamic way and according to the users' needs. In addition, users only pay for the services that they consume.

However, despite the fact that the cloud offers various benefits for enterprises, from flexibility to cost reduction, moving an existing system to the cloud is not an easy task, because there are a number of factors that may affect an organisation's decision to move to the cloud. The literature review made it clear that there are a few empirical studies that have been conducted to investigate the factors that have an impact on an organisation's decision in this regard. But, these studies were conducted on a specific number of factors, and left other factors (trust, privacy and physical location) that might influence an organisation's intention to adopt cloud services without investigation. Furthermore, there is no study combining all these factors together (quality of service, security, privacy, trust, relative advantage, compatibility, complexity, top management support, organisation size, technological readiness, compliance with regulations, competitive pressure, trading partner pressure, and physical location) to examine their impacts on the adoption decision. In fact, the rate of adoption of cloud computing is still in the early stages in developing countries such as Saudi Arabia, and to the best of the author's knowledge, no study has been conducted in the private sector in Saudi Arabia to examine the impact of these factors on the adoption rate.

Therefore, this research proposed an integrated model, in attempting to identify the most influential factors that can encourage an organisation to use the cloud or which might impede them in relation to moving to it. The initial model integrates the critical factors from the

literature review, along with other factors (such as physical location) that have not yet been investigated in any previous study as main factors that may have an impact on the organisation's intention to adopt cloud services.

In order to refine and confirm the factors in the cloud adoption model, the study utilised both qualitative and quantitative methods (i.e., a mixed method). Semi-structured interviews were used to review the proposed factors that were identified previously in Chapter 3 and to explore other factors that were unmentioned in previous studies. Further, an online questionnaire was conducted in order to confirm the existing factors in the proposed model and other factors that were identified from the interviews reported in Chapter 5 (trialability, external support, industry, and culture). In this stage, the study found that complexity, competitive pressure and trading partner pressure, did not significantly impact the adoption decision. Consequently, these factors were excluded from the model.

Finally, this study utilised a quantitative method to evaluate and test the proposed model for cloud adoption, as shown in Figure 5-1 in Chapter 5. The questionnaire survey was been carried out with 300 IT staff in different organisations in the private sector in Saudi Arabia. The collected data was analysed through SEM in two stages: measurement model assessment and structural model assessment. At the measurement level, the composite reliability and construct validity were utilised to verify the measurements used in this research. In the structural level, the relationships between the factors and organisations' intention to adopt the cloud in both SME and large enterprises were examined, to explore factors that were positively or negatively associated with cloud adoption in private companies in Saudi Arabia; so, the proposed hypotheses was assessed in this stage.

The findings of the evaluation study, which were presented in Chapter 7, confirmed that the proposed model was well-fitting with the collected data. Furthermore, the results showed that there was both a direct and indirect impact of the factors on an organisation's decision to adopt the cloud. Quality of service, security, privacy and trust were found to have a direct effect on cloud adoption. However, the security and privacy concerns were still one of barriers towards adoption of this technology in Saudi Arabia. Moreover, these concerns exist even in the adopter companies. Furthermore, technology readiness was found to have a direct effect in SME, as well as with non-adopter companies. The other factors were found to have a negative, indirect influence. These factors are relative advantage, compatibility, trialability,

top management support, external support, and culture. Moreover, this research confirmed that the physical location has a direct impact on compliance with regulation and on privacy.

This study also investigated the difference between organisations that already used cloud and non-adopters. The results of this study showed that the effect of these variables differed in organisations that already used the cloud and non-adopters. Also, it showed that the organisation's size has an effect on the relationship between the factors and the adoption decision. These results were presented and discussed in detail in Chapter 7 and Chapter 8. In this research, it was observed that the large organisations tended to adopt cloud services more readily than SME. This finding was consistent with those of former studies (Low et al., 2011; Oliveira et al., 2014), which concluded that large organisations are more willing to adopt cloud services. On the whole, the findings of this study supported 20 hypotheses out of the 32 hypotheses that were examined.

It can be concluded that the proposed model is valuable in explaining the adoption of the cloud at organisational level. It is believed that the findings of this study can assist decision makers, cloud providers and the research community in introducing better strategies for encouraging adoption of this technology. The findings can also add to their awareness and understanding of why some organisations are utilising the cloud while others are not.

9.2 Revisiting the Research Objectives

As mentioned in Chapter 1, the aim of this research was to carry out an in-depth investigation of the factors that influence an organisation's intention to adopt cloud technology in the private sector in Saudi Arabia and to understand why some enterprises are more prepared than others to move to the cloud. The objectives of this study, which were presented in Chapter 1, to address the above aim, were accomplished as follows:

- To identify the factors that might influence an organisation's decision to adopt cloud technology.

The qualitative and quantitative methods (i.e., a mixed method) used in the exploratory study (Chapter 5), verified the factors that influence an organisation's decision to adopt cloud technology. There were fifteen factors identified in the study which were found to

play a significant role in cloud adoption. These factors are: quality of service, security, privacy, trust, relative advantage, compatibility, trialability, top management support, organisation size, technological readiness, compliance with regulations, physical location, external support, industry and culture. However, complexity, competitive pressure and trading partner were not found to be significant factors in this research.

- To develop a conceptual model that can be utilised to examine the adoption of cloud computing in organisations.

In this research an integrated model was proposed from the literature review on technology adoption and cloud computing, along with other factors (such as physical location) that had not been examined in existing studies. The related factors in the research model were also explored and confirmed through interviews and the questionnaire in the exploratory study (Chapter 5). Finally, the model was tested quantitatively with a large sample size and the results confirmed that the developed model was well-fitted with the collected data. Thus, the proposed model is considered to be valuable in explaining the adoption of the cloud technology at organisational level.

- To explore factors that encourage or impede cloud adoption in the private sector in Saudi Arabia by evaluating the conceptual model quantitatively.

This objective was achieved through quantitatively testing the proposed research model (Figure 5-1) in Chapter 5 and using a powerful multivariate technique, SEM, for data analysis. The findings of this study showed that the quality of service and trust are the most influential factors in cloud adoption. However, security and privacy concerns still limit adoption in the private sector in Saudi Arabia. Furthermore, six factors were found to have a negative influence on the adoption of the cloud. These factors were relative advantage, compatibility, trialability, top management support, external support, and culture. This study also showed that the physical location had a significant impact on compliance with regulation and privacy.

- To fill the gap in the existing literature and provide guidelines for organisations, technology providers, managers, government and policy makers who are interested in

increasing the adoption and spreading of new technologies like cloud computing in a developing country such as Saudi Arabia.

This study has filled the gap in the existing literature by examining the impact of technological, organisational, environmental and social factors on the adoption rate in the private sector in Saudi Arabia, as no study has been conducted previously. This is the first study that examines the impact of the physical location of the cloud on adoption and it confirmed that this factor has a significant effect on compliance with regulation and privacy. It is believed that the findings of this research provide a valuable information resource for technology providers, managers, government and policy makers, and can increase their understanding of those problems which require more effort from their side.

9.3 Research Contributions

The following section presents the research contributions, which are divided into two sections: theoretical contributions and practical contributions.

9.3.1 Theoretical Contributions

This study contributes to the research in the fields of both cloud computing and adoption of new IT innovations by studying adoption of cloud technology at organisational level in Saudi Arabia. The adoption rate of cloud technology in Saudi Arabia is still low and in the early stage. Therefore, this research proposed an integrated model in an attempt to find out what might encourage an organisation to use cloud services or might impede them from using it. The cloud adoption model integrates the critical factors identified from the literature review with other factors that have not been examined in previous studies to examine the impact of these variables on the adoption decision of enterprises. It is different from former studies, as no study exists combining all these factors together: technological factors (quality of service, security, privacy, trust, relative advantage, compatibility, trialability); organisational factors (top management support, and technology readiness); environmental factors (compliance with regulations, physical location, external support, and industry) and a social factor (culture), to examine their effects on the adoption decision. Furthermore, to the best of the author's knowledge, this is first study to examine the impact of these factors on the adoption rate in the private sector in Saudi Arabia.

In addition, the impact of physical location, privacy and trust on cloud adoption have not been studied in previous studies (see Table 3-1). Thus, the inclusion of these factors in this study is a further contribution to the body of knowledge on this topic. This study is one of first studies to investigate the effect of the physical location on an organisation's decision to adopt cloud services. Moreover, it is the first study to have examined and confirmed that the physical location has a significant impact on compliance with regulation and privacy. This work also considered the social dimension, unlike former studies (Low et al., 2011; Borgman et al., 2013; Chang et al., 2013; Nkhoma and Dang, 2013; Oliveira et al., 2014) which did not take the effect of the social aspect into consideration.

Furthermore, this work has filled the research gap by assessing the impact of an organisation's size on the relationships between the factors and an organisation's intention to adopt cloud services. In the previous work the effect of the organisation's size as a moderator was not studied. Hence, this research has enriched the existing literature and increased our understanding of the difference between SME and large enterprises in the effect of these variables.

Although the adoption rate of cloud services in Saudi Arabia is still at the initial stage, this research has investigated and shown the differences between companies that were already using cloud services and non-adopters. Overall, this research does not merely fill this research gap, but also provides a comprehensive evaluation of the technological, organisational, environmental and social factors affecting cloud adoption. This study has increased understanding of the current situation and concerns regarding cloud adoption, especially in Saudi Arabia.

The other main contribution of this research is the proposed model. The model in this research was constructed from the literature review along with other factors that have not been investigated in previous studies, and then the related factors were also explored through the interviews with IT experts (Chapter 5). The factors in cloud adoption were then confirmed through the questionnaire in the exploratory study (Chapter 5). Finally, the cloud adoption model was evaluated quantitatively, using a large sample (n = 300), in order to assess the relationships between the factors and an organisation's intention to adopt cloud services: in other words, to explore the factors that encourage or impede cloud adoption in

the private sector in Saudi Arabia. The results confirmed that the proposed model fitted well with the data. Thus, the developed model is considered to be valid and capable of making a valuable contribution in explaining the adoption of the cloud at organisational level.

A further contribution of this research is the new instrument developed. The basic questions in the survey that were used to measure the factors in the cloud adoption model were adapted from former studies. However, some questions were modified to fit the research context and other items were added by the researcher. Furthermore, the instrument was translated into Arabic and reviewed by experts. The reliability and validity of the instrument utilised in this research has been verified and presented in Chapter 7. Consequently, it can be concluded that the instruments introduced in this research are well designed. Thus, the integrated model and the instruments used in this research are the contributions of this study, along with the factors identified, and can be used in any future studies concerning the adoption of new technologies. The translated version of the instrument can also be used by other researchers who are interested in conducting research in an Arabic context. It is considered that this research provides a valuable information resource for future researchers in the cloud adoption area, as well as in the area of new technologies adoption generally.

9.3.2 Practical Contributions

9.3.2.1 Implications for Service Providers and Technology Consultants

The Saudi private sector is an important market for cloud service providers or software vendors, as most of businesses in Saudi Arabia belong to the private sector. Therefore, this research has important implications for technology consultants and cloud providers and will help them to understand the problems that face organisations regarding adoption of the cloud and the factors that affect their decision. The findings of this research showed that some organisations in Saudi Arabia did not feel that the cloud would bring significant benefits to their organisations. Consequently, effort from cloud providers is needed to increase understanding and awareness of the benefits of this technology in organisations, through energising the promotional activities such as promotional workshops and seminars. Moreover, such activities can increase the Saudi sense of community culture. According to Iacovou et al. (1995), promotional activities can increase and speed up the adoption of innovation.

Further, this research has found that organisations in Saudi Arabia suffer from lack of support from cloud providers and trialability of this technology, as well as being still concerned about security and privacy, which is inhibiting cloud adoption. So there is a need for more effort from cloud providers in order to increase the level of adoption in this country. Round-the-clock support from the cloud provider side is needed. The providers should enable enterprises to try the services of this technology for a sufficient period of time and this would help them to assess the benefits of cloud to their business. In addition, this will reduce concerns regarding compatibility. Furthermore, it is essential that the cloud providers consider the location of the data centres to be inside Saudi Arabia. This would play an important role in minimising security and privacy concerns in organisations and compliance issues. The providers also need to increase their interaction with organisations, even with adopters, and especially with SME, as most of the enterprises who already employed cloud services in the Saudi private sector were large enterprises. This would also help to create a secure environment and to decrease the uncertainty of this technology. In summary, the findings of this study can assist the cloud providers and improve their understanding of why the adoption of this technology still low in Saudi Arabia as well as why some organisations have decided to use cloud services while others have not. This can increase their understanding of the problems that require more effort from their side.

9.3.2.2 Implications for Government

The findings of this study showed the physical location of cloud data centres has a significant impact on compliance with regulations and on privacy, as every country has different privacy legislation. To overcome the issues regarding compliance with regulations in cloud technology and privacy concerns, there is need for support from the government side. The Saudi government needs to work in introducing suitable regulations or updating their regulations to comply with the requirements of the cloud. For example, the government could coordinate the legislation between countries regarding data protection in cloud technology.

9.3.2.3 Implications for Managers

Support from top management is needed to increase the adoption of cloud computing in Saudi Arabia. This study showed that some enterprises in the Saudi private sector still suffer

from lack of support of top management for cloud adoption. So, the cloud adoption decision does not only depend on the views of decision-makers in the IT department. The adoption requires both support from top management and decision-makers in the IT department. The findings of this study and the research model provide valuable information for managers and could help them to evaluate the characteristics of cloud technology, as well as the characteristics of the organisation and its environment, before employing cloud services. Moreover, the managers could use the proposed model for assessing other technologies in the future. The managers also need to take into consideration the choice of cloud service provider that provides sufficient support before and after the adoption of cloud services, as well as supporting the future plans of their organisation.

On the whole, taking all the above contributions into consideration, this research provides valuable information and guidelines for organisations, technology providers, managers, government and policy makers in increasing the implementation and spreading of cloud computing in Saudi Arabia.

9.4 Lessons from the Research

One of the lessons learnt from the study was that the literature review plays the key role in the research process. The literature review made it clear that the number of empirical studies investigating the factors which influence cloud adoption decisions at an organisational level was small. Furthermore, these studies were conducted only on a specific number of factors, and neglected other influential factors which could have an impact on the intention to use a cloud services, such as physical location. Conducting this review helped to understand the subject of the study and existing research and identify the research gaps, as well as helping to choose the data collection strategies and analysis procedure.

Furthermore, the adopted methodology was another important part in the research process. By combining two research methods, interviews and questionnaires, it provided a clearer picture of the problem and answered the research questions. It helped the researcher to understand problems in an extensive way and increased the confidence and accuracy of the research findings, and thus helped to develop the cloud adoption model.

Using the SEM approach for evaluating the proposed model for cloud adoption was one of challenges encountered in this study, as this approach requires large size of sample. The minimum sample size for performing a reliable and robust analysis like SEM is 200 participants. The number of participants used in this study was 300 IT staff working in the private sector in Saudi Arabia. Thus, the scale of data collection was one of problems that faced this research: it took more than six months, as the questionnaire was distributed to IT staff online and through the traditional method on paper, in order to increase the response rate. However, on the whole, using a large sample size increased the generalisability of the results.

9.5 Limitations of the Study

Even though the present study achieved its objectives, it still has some limitations. Although the SEM approach has the ability to analyse data with multiple groups, such as different organisation sizes, it only allows analysis of two groups. Therefore, the data for the variable organisation size was recoded into two groups: SME (1-250 employees) and large enterprises (more than 250 employees). This restriction limited the analysis of the effect of the size of an organisation to only two groups, SME and large enterprises, instead of four (micro, small, medium and large enterprises).

Another limitation is that, although the questionnaire was checked by researchers at the University of Southampton and the results of the analyses were reliable, some statements in the questionnaires' instruments in the exploratory study need to be rewritten in a clearer form in future studies, to get better results. For example, the questions related to the complexity factor.

9.6 Future Research Directions

The present study opens the door for further research in future. This study focused on investigations into the factors that impact on cloud adoption in private sector in Saudi Arabia. The research is conducted only in the private sector in Saudi Arabia, which means the study only reflects the situation of that country. Future study could investigate cloud adoption in public sector and compare the private and public sector in Saudi Arabia. Overall,

the research model could be applied in other countries and sectors, not just in Saudi Arabia. Moreover, the model can be used in future for studying adoption of a new IT innovation.

This research studied the relationships among construct variables that had been identified in the model. Although this study includes the key variables that might impact on cloud adoption, future studies could extend the developed model by adding other factors, for example, the role of government in cloud adoption. The relationship between culture and trust also needs more investigation in future research.

Further, the sample of this study was limited to IT staff; this was due to their ability to understand the new information system technology and current situation of their organisation as well the future trends. Future research should take into account the view of top managers and cloud providers; this will help in understanding issues related to adoption more deeply.

Due to the limited time available for this research and the cost, the methods used to achieve the objectives of this research were limited to certain qualitative (i.e., semi structured interviews) and quantitative (i.e., survey) methods. Although this study analysed the data through using a powerful multivariate technique, SEM, other studies could utilise other methods, such as case studies, by conducting interviews with different people in the same organisations (e.g., IT staff, top management and end-users).

Finally, this study measured the acceptance of cloud technology only at organisational level. Consequently, this study opens possibilities for further research to analyse the adoption of cloud at individual level, through utilising other theories such as the TAM model (Davis, 1989), and Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al., (2003).

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Appendix A Interview Questions

1. How important are the following attributes to the adoption of cloud computing services?

Attributes	**Very important**	**Important**	**May be important**	**Not important**	**Not relevant**
Availability of cloud service					
Reliability					
Security					
Privacy					
Trust					
Relative advantage					
Compatibility					
Complexity					
Top management support					
Organisation size					
Technology readiness					
Compliance with regulations					
Competitive pressure					
Trading partner pressure					
Physical location					

2. In your opinion, what other important factors need to be considered when an organisation intents to adopt cloud computing?

3. Does your organisation adopt cloud computing?

4. What are the reasons behind using/not using cloud computing in your organisation?

5. What are the challenges that your organisation faced with using cloud computing? (If your organisation adopted cloud computing answer this question)

Appendix B Results of the Interviews

Table B-1 The percentage of participants' responses.

Factors		Variable	Frequency	Percentage
QoS	Availability	Very important	15	75%
		Important	5	25%
	Reliability	Very important	18	90%
		Important	2	10%
Security		Very important	20	100%
Privacy		Very important	16	80%
		Important	3	15%
		May be important	1	5%
Trust		Very important	15	75%
		Important	4	20%
		Not relevant	1	5%
Relative advantage		Very important	12	60%
		Important	8	40%
Compatibility		Very important	7	35%
		Important	11	55%
		May be important	1	5%
		Not important	1	5%
Complexity		Very important	4	20%
		Important	13	65%
		May be important	2	10%
		Not important	1	5%
Top management support		Very important	16	80%
		Important	4	20%
Organisation size		Very important	4	20%
		Important	10	50%
		May be important	3	15%
		Not important	3	15%
Technology readiness		Very important	5	25%
		Important	13	65%
		May be important	2	10%
Compliance with regulations		Very important	17	85%
		Important	3	15%
Competitive pressure		Very important	3	15%
		Important	10	50%
		May be important	5	25%
		Not important	1	5%
		Not relevant	1	5%
Trading partner pressure		Very important	3	15%
		Important	8	40%
		May be important	5	25%
		Not important	2	10%
		Not relevant	2	10%
Physical location		Very important	10	50%
		Important	6	30%
		May be important	2	10%
		Not important	1	5%
		Not relevant	1	5%

Table B-2 Reasons behind using cloud computing at the participated companies.

Themes	**Codes**
-*Cost reduction* **(Expert A)**.	Relative advantage
-*Cost saving, save time (Fast) and resources (man power) required along with storage (backup is high)* **(Expert C)**.	
-*Mainly the agility and flexibility to provide to the end users (requesters) quick answers to their requests.* *- Easy to maintain the solution, which reduces the Capex* **(Expert D)**.	
- One of the reasons we decided to use cloud services was because the cost was much lower than paying for servers and hiring people to do this. So, cost saving would be the primary thing allowing us to work in more strategies. We don't have to wary about the email and so on **(Expert E)**.	
-*Using: It saves a lot of implementation, deployment, and update time* **(Expert F)**.	
-*User friendly* **(Expert G)**.	
-*High reliability with customer relationship management (CRM)* **(Expert G)**.	Reliability
-*Highly compatible with existing technology* **(Expert G)**.	Compatibility

Table B-3 Experts suggestions.

Experts suggestions	codes
-*The cost of course is very important in the top management view* **(Expert D)**. -*The main things from a technical point of view are flexibility and agility and especially how fast I can bring the application up and running and how fast I can provide the resources when there is a request for them* **(Expert D)**.	Relative advantage
-*One consideration that we have to take into account is cost. This very common in IT anywhere: driving the cost down as much as possible. So, one of the reasons we decide to use cloud services is because the cost much lower than paying for servers and hiring people to do this* **((Expert E)**.	
-*Cost saving: this concept is related to relative advantage* **(Expert N)**.	
- The cost and flexibility should be there **(Expert P)**.	
- Scalability **(Experts H and N)**.	
- To keep the business continuity, check if the provider of the cloud has a high availability solution **(Expert D)**.	Quality of service (availability)
-*Performance: it's very important and one of key success factors that cloud computing has to have* **(Expert I)**.	
-Interoperability is one of the factors that need to be considered **(Expert H and N)**.	Compatibility
- Synchronisation with another system **(Expert L)**.	
-*Third party software licence. When you are migrating something to the cloud we have to see if the third party*	

software licence is compatible with our system **(Expert O)**.	
-*Compatibility with existing applications* **(Expert P)**.	
-*Skill set of the team: the organisation needs to look at the skill set of technical people whether they can manage or operate those services within the organisation. This I think is one important factor that needs to be taken in consideration* **(Expert A)**.	Technology readiness
-*It's very important to understand the technology because the concept is new for our company. We still have a gap in skills. We need more skilled people, more work to be done at the manpower level. We need more skilled people to run this infrastructure and this solution* **(Expert E)**.	
-*The location of the server/data centres* **(Expert F)**.	Physical location

Table B-4 Results of one-sample t-test (test value 3).

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Availability	20	4.75	.444	.099
Reliability	20	4.90	.308	.069
Security	20	5.00	.000[a]	.000
Privacy	20	4.75	.550	.123
Trust	20	4.60	.940	.210
Relative advantage	20	4.60	.503	.112
Compatibility	20	4.20	.768	.172
Complexity	20	4.00	.725	.162
Top management support	20	4.80	.410	.092
Organisation size	20	3.75	.967	.216
Technology readiness	20	4.15	.587	.131
Compliance with regulations	20	4.85	.366	.082
Competitive pressure	20	3.65	.988	.221
Trading partner pressure	20	3.40	1.188	.266
Physical location	20	4.15	1.137	.254

One-Sample Test

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Availability	17.616	19	.000	1.750	1.54	1.96
Reliability	27.606	19	.000	1.900	1.76	2.04
Privacy	14.226	19	.000	1.750	1.49	2.01
Trust	7.610	19	.000	1.600	1.16	2.04
Relative advantage	14.236	19	.000	1.600	1.36	1.84
Compatibility	6.990	19	.000	1.200	.84	1.56
Complexity	6.164	19	.000	1.000	.66	1.34
Top management support	19.615	19	.000	1.800	1.61	1.99
Organisation size	3.470	19	.003	.750	.30	1.20
Technology readiness	8.759	19	.000	1.150	.88	1.42
Compliance with regulations	22.584	19	.000	1.850	1.68	2.02
Competitive pressure	2.942	19	.008	.650	.19	1.11
Trading partner pressure	1.506	19	.148	.400	-.16	.96
Physical location	4.524	19	.000	1.150	.62	1.68

Table B-5 Results of paired-samples t-test (adopters and non-adopters).

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	adopters	.35	20	.489	.109
	nonadopters	.65	20	.489	.109

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	adopters - nonadopters	-.300	.979	.219	-.758	.158	-1.371	19	.186

Appendix C Questionnaire

Questionnaire

The aim of this research is to investigate the factors that may influence an organisation's intent to adopt cloud computing in Saudi Arabia. Your responses and expertise will help in improving the constructed model for the adoption of cloud computing. All information provided will be used for research purposes only. Thank you very much for taking part in this study.

1. Number of employees in your organisation:

□ 1-9 Employees

□ 10-49 Employees

□ 50-250 Employees

□ More than 250 Employees

2. Business nature of your organisation:

□ Manufacturing □ Petrochemical □ Chemicals □ Engineering

□ Energy □ Financial services □ IT □ Retail

□ Other (please specify_____)

3. Market scope of your organisation:

□ International

□ Local

□ National

4. To what extent do you agree with the following statements?	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
1. Cloud services should be available to support our IT operations.					
2. The reliability of cloud technology has an impact on our decision to use it.					
3. Security is an important factor when it comes to cloud computing.					
4. Security concerns affect our decisions to use cloud services.					
5. Privacy is a critical issue that affects our decision to use cloud services.					
6. Cloud computing technology is trustworthy.					
7. Storing our organisation's data under third-party control is a concern of ours.					
8. The use of cloud computing in our organisation will help us to reduce costs.					
9. Cloud computing services will help us to accomplish tasks quickly.					
10. The compatibility of cloud technology with our work style has a direct impact on our decisions to use cloud services.					
11. Cloud technology is still complex.					
12. It is essential to try cloud computing before using it in our organisation.					
13. Management approval is essential before the cloud can be adopted in our organisation.					
14. Organisation size needs to be considered before using cloud technology.					
15. Technical knowledge is essential to adopt cloud computing.					
16. Having skills to use cloud technology is essential.					

17. Having strong technical infrastructure (e.g., high bandwidth) would encourage us to use cloud computing.					
18. Having a high speed of Internet would encourage us to use cloud computing.					
19. Compliance with regulations affects our decision to use cloud services.					
20. If our competitors adopted cloud computing, it would encourage us to use cloud services in our organisation.					
21. It is important to know where the cloud providers will store our data.					
22. Storing our data in a cloud that runs in a different country could lead to the issue of compliance with regulations.					
23. Storing our data in a cloud that runs in a different country has an impact on the privacy of data.					
24. Knowing the physical location is not important as long as the cloud provider ensures the security of our data.					
25. Knowing the physical location is not important as long as the cloud provider ensures the privacy of our data.					
26. Support from the cloud providers is essential for using cloud services.					
27. Using cloud technology depends on the nature of business in the organisation.					
28. The cultural aspect is an important factor that should be taken into consideration when we use cloud technology.					

5. Does your organisation adopt cloud computing?

□ Yes □ No (go to question 6)

6. Does your organisation intend to adopt cloud services in future?

□ Yes □ No

Appendix D Results of the Questionnaire

Table D-1 The frequency and percentages of participants' responses.

Factors		Variable	Frequency	Percentage
QoS	Availability	Strongly Agree	12	40%
		Agree	17	56.7%
		Neutral	1	3.3%
	Reliability	Strongly Agree	17	56.7%
		Agree	8	26.7%
		Neutral	5	16.7%
Security 1		Strongly Agree	24	80%
		Agree	6	20%
Security 2		Strongly Agree	20	66.7%
		Agree	10	33.3%
Privacy		Strongly Agree	18	60%
		Agree	12	40%
Trust 1		Strongly Agree	5	16.7%
		Agree	14	46.7%
		Neutral	6	20%
		Disagree	4	13.3%
		Strongly Disagree	1	3.3%
Trust 2		Strongly Agree	13	43.3%
		Agree	12	40%
		Neutral	3	10%
		Disagree	2	6.7%
Relative advantage 1		Strongly Agree	11	36.7%
		Agree	10	33.3%
		Neutral	5	16.7%
		Disagree	3	10%
		Strongly Disagree	1	3.3%
Relative advantage 2		Strongly Agree	2	6.7%
		Agree	9	30%
		Neutral	9	30%
		Disagree	2	6.7%
Compatibility		Strongly Agree	7	23.3%
		Agree	18	60%
		Neutral	4	13.3%
		Disagree	1	3.3%
Complexity		Strongly Agree	3	10%
		Agree	12	40%
		Neutral	5	16.7%
		Disagree	9	30%
		Strongly Disagree	1	3.3%
Trialability		Strongly Agree	10	33.3%
		Agree	16	53.3%
		Neutral	3	10%
		Disagree	1	3.3%
Top management support		Strongly Agree	22	73.3%
		Agree	8	26.7%
Organisation size		Strongly Agree	14	46.7%
		Agree	16	53.3%
Technology readiness1		Strongly Agree	16	53.3%
		Agree	14	46.7%
Technology readiness2		Strongly Agree	8	26.7%
		Agree	18	60%

	Neutral	4	13.3%
Technology readiness 3	Strongly Agree	17	56.7%
	Agree	12	40%
	Neutral	1	3.3%
Technology readiness 4	Strongly Agree	21	70%
	Agree	7	23.3%
	Neutral	1	3.3%
	Disagree	1	3.3%
Compliance with regulations	Strongly Agree	16	53.3%
	Agree	11	36.7%
	Neutral	3	10%
Competitive pressure	Strongly Agree	2	6.7%
	Agree	12	40%
	Neutral	9	30%
	Disagree	5	16.7%
	Strongly Disagree	2	6.7%
Physical location 1	Strongly Agree	22	73.3%
	Agree	7	23.3%
	Neutral	1	3.3%
Physical location 2	Strongly Agree	11	36.3%
	Agree	12	40%
	Neutral	2	6.7%
	Disagree	5	16.7%
Physical location 2	Strongly Agree	11	36.7%
	Agree	12	40%
	Neutral	2	6.7%
	Disagree	5	16.7%
Physical location 3	Strongly Agree	14	46.7%
	Agree	9	30%
	Neutral	4	13.3%
	Disagree	3	10%
Physical location 4	Strongly Agree	5	16.7%
	Agree	8	26.7%
	Neutral	1	3.3%
	Disagree	9	30%
	Strongly Disagree	7	23.3%
Physical location 5	Strongly Agree	4	13.3%
	Agree	9	30%
	Neutral	3	10%
	Disagree	9	30%
	Disagree	5	16.7%
External Support	Strongly Agree	22	73.3%
	Agree	7	23.3%
	Neutral	1	3.3%
Industry	Strongly Agree	10	33.3%
	Agree	14	46.7%
	Neutral	5	16.7%
	Strongly Disagree	1	3.3%
Culture	Strongly Agree	7	23.3%
	Agree	14	46.7%
	Neutral	8	26.7%
	Disagree	1	3.3%

Table D-2 The analysis of the survey (one-sample t-test).

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Availability	30	4.37	.556	.102
Reliability	30	4.10	.662	.121
Security 1	30	4.80	.407	.074
Security 2	30	4.67	.479	.088
Privacy	30	4.60	.498	.091
Trust 1	30	3.60	1.037	.189
Trust 2	30	4.20	.887	.162
Relative advantage 1	30	3.90	1.125	.205
Relative advantage 2	30	3.90	.960	.175
Compatibility	30	4.03	.718	.131
Complexity	30	3.23	1.104	.202
Trialability	30	4.17	.747	.136
Top management support	30	4.73	.450	.082
Organisation size	30	4.47	.507	.093
Technology readiness 1	30	4.53	.507	.093
Technology readiness 2	30	4.13	.629	.115
Technology readiness 3	30	4.53	.571	.104
Technology readiness 4	30	4.60	.724	.132
Compliance with regulations	30	4.43	.679	.124
Competitive pressure	30	3.23	1.040	.190
Physical location 1	30	4.70	.535	.098
Physical location 2	30	3.97	1.066	.195
Physical location 3	30	4.13	1.008	.184
Physical location 4	30	2.83	1.487	.272
Physical location 5	30	2.93	1.363	.249
External support	30	4.70	.535	.098
Industry	30	4.07	.907	.166
Culture	30	3.90	.803	.147

One-Sample Test

	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Availability	13.462	29	.000	1.367	1.16	1.57
Reliability	9.104	29	.000	1.100	.85	1.35
Security 1	24.233	29	.000	1.800	1.65	1.95
Security 2	19.039	29	.000	1.667	1.49	1.85
Privacy	17.588	29	.000	1.600	1.41	1.79
Trust 1	3.168	29	.004	.600	.21	.99
Trust 2	7.413	29	.000	1.200	.87	1.53
Relative advantage 1	4.382	29	.000	.900	.48	1.32
Relative advantage 2	5.137	29	.000	.900	.54	1.26
Compatibility	7.878	29	.000	1.033	.77	1.30
Complexity	1.157	29	.257	.233	-.18	.65
Trialability	8.558	29	.000	1.167	.89	1.45
Top management support	21.108	29	.000	1.733	1.57	1.90
Organisation size	15.832	29	.000	1.467	1.28	1.66
Technology readiness 1	16.551	29	.000	1.533	1.34	1.72
Technology readiness 2	9.872	29	.000	1.133	.90	1.37
Technology readiness 3	14.699	29	.000	1.533	1.32	1.75
Technology readiness 4	12.105	29	.000	1.600	1.33	1.87
Compliance with regulations	11.564	29	.000	1.433	1.18	1.69
Competitive pressure	1.229	29	.229	.233	-.16	.62
Physical location 1	17.405	29	.000	1.700	1.50	1.90
Physical location 2	4.966	29	.000	.967	.57	1.36
Physical location 3	6.158	29	.000	1.133	.76	1.51
Physical location 4	-.614	29	.544	-.167	-.72	.39
Physical location 5	-.268	29	.791	-.067	-.58	.44
External support	17.405	29	.000	1.700	1.50	1.90
Industry	6.440	29	.000	1.067	.73	1.41
Culture	6.139	29	.000	.900	.60	1.20

Appendix E Questionnaire for Evaluation Study

Questionnaire (English version)

Thank you for taking a few minutes to answer this questionnaire. This study is about the adoption of cloud computing at the organisational level. The aim of this research is to investigate the factors that may influence an organisation's intention to adopt cloud computing in private sector in Saudi Arabia. All information provided will be used for research purposes only. Thank you very much for taking part in this study.

Would you like to take part in this research?

 Yes, I agree to take part in this research and I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected.

 No, I disagree.

Part I: Company Details

Q1. Work experience in information technology field:

- 2-5 years
- 6-10 years
- More than 10 years

Q2. Number of employees in your organisation:

- 1-9 employees
- 10-49 employees
- 50-250 employees
- More than 250 employees

Q3. Company age (years):

- Less than a year
- 1-5 Years
- 6-10 Years
- 11-20 Years
- More than 20 years

Q4. Annual revenue of your organisation (US $):

- Less than 1 million
- 1-5 million
- 6-20 million
- More than 20 million

Q5. Business nature of your organisation:

- Chemicals
- Energy/Utilities
- Engineering
- Financial services
- IT
- Manufacturing
- Oil/Gas
- Petrochemical
- Retail
- Telecommunications
- Other (Please specify ……..…….)

Q6. Market scope of your organisation:

- International
- Local

National

Q7. Does your organisation adopt cloud computing?

Yes No

Q8. What types of cloud computing does your organisation use?

Public cloud

Private cloud

Hybrid cloud

N/A

Part II: To what extent do you agree with the following statements?

Q1. Intention to adopt Cloud	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
It is likely that my organisation will take steps to adopt cloud technology in the future.					
My organisation intends to adopt cloud computing in the future.					
I think, in the near future, I would not hesitate to use cloud services in my organisation.					
I feel comfortable recommending cloud computing technology to my organisation.					

Q2. Quality of Service	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Cloud services should perform well to support our IT operations effectively.					
Cloud computing allows us to access services any time (i.e., 24/7).					
Cloud computing allows us to access services from anywhere.					
Having a high quality of service would encourage us to use cloud computing.					
Providing good compensation for downtime or failure to provide expected service would encourage us to use cloud computing.					
Ensuring a good backup service would encourage us to use cloud technology.					

Q3. Security	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I feel that cloud computing is not secure enough to store our organisation's data.					
I feel that traditional computing methods are more secure than cloud computing technology.					
Security in general is a critical issue that affects our decision to use cloud services.					
I feel that the risks of cloud services outweigh the benefits.					

Q4. Privacy	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Privacy concerns affect our decision to use cloud services.					
My personal information in the cloud may be exposed to other parties without my knowledge.					
The cloud service provider may allow other parties to access my organisation's information in the cloud without our consent.					

I would use cloud services if the privacy of my company's information was guaranteed.					

Q5. Trust	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I feel confident storing my organisation's data in the cloud.					
I feel assured that I am protected from problems in the cloud due to adequate technological structures.					
Storing our organisation's data under third-party control is one of our concerns.					
My organisation's information in the cloud may be used by a third party without our consent.					

Q6. Relative Advantage	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
The use of cloud computing in our organisation will help us to accomplish tasks more quickly.					
The use of cloud computing in our organisation will enable us to cut costs.					
Using cloud computing services increases our productivity.					
Using cloud computing can increase flexibility in our organisation.					

Q7. Compatibility	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
The compatibility of cloud computing with aspects of our work would encourage us to use it.					
I would use cloud services if they were consistent with our needs.					
Using cloud computing fits our work style.					
Cloud computing is Not compatible with all aspects of our work.					

Q8. Trialability	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
It is essential to be able to try out cloud services properly before deciding to use them.					
Before making a decision whether to adopt cloud services, it is essential to try out those services for a sufficient period to see how they work.					
Being able to use cloud technology on a trial basis will encourage us to adopt it in our organisation.					
It is necessary to know how to deal with services of cloud computing before deciding to adopt it.					

Part III: To what extent do you agree with the following statements?

Q1. Top Management Support	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Top management support is essential for adopting cloud services in our organisation.					
The decision to adopt cloud services in our organisation depends on top management.					
It is necessary for top management to be involved in decision making in relation to cloud computing.					
It is essential for the top management team to be involved in reviewing a consultant's cloud computing recommendations.					

Q2. Technology Readiness	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Having a robust technical infrastructure (e.g., high bandwidth) would enable us to use cloud technology.					
Having a fast Internet connection would encourage us to adopt cloud technology.					
Having the necessary technical skills would enable us to use cloud technology					
My organisation still has limited technical knowledge about cloud computing technology.					
Cloud computing requires technical knowledge to use.					
We still lack in technical skills of using cloud technology in our organisation.					

Q3. Compliance with Regulations	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I would use cloud services if they complied with our regulations.					
I would use cloud services if they complied with our industrial rules.					
The laws and regulations that exist nowadays are not sufficient to protect information stored in the cloud.					
It is necessary that cloud computing regulations comply with law in Saudi Arabia.					

Q4. Physical Location	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I would use cloud services if the data centre location was known to me.					
I would use cloud services if the data centre was located in Saudi Arabia.					
I would store my firm's data in the cloud if the data centre was located in Saudi Arabia.					
It is necessary for us to know where the cloud provider will store our data.					

Q5. External Support	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
It is necessary to have adequate technical support from the cloud provider before adopting cloud computing.					
It is necessary to have adequate technical support from the cloud provider after adopting cloud computing.					
Having sufficient support from the cloud provider would encourage us to use cloud technology.					
It is necessary to pursue software vendors who offer adequate advice.					
It is important to have good relationships with other parties (e.g., providers).					

Q6. Industry	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The nature of the industry in which our firm operates influences our adoption decision.					
Using cloud technology depends on the type of business in an organisation.					
Cloud technology is more relevant to sectors that have high computing requirements.					

Q7. Culture	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Expert opinions affect our decision to use cloud services.					
Cloud computing technology could lead to departmental downsizing in our organisation, when there is a need to create jobs for communities in Saudi Arabia rather than outsourcing.					
I would use cloud services if the provider was based in Saudi Arabia.					
In general, we like to try new technology that facilitates our work.					

Thank you for taking part in this survey.

Questionnaire (Arabic version)

شكرا لأخذ بضع دقائق من وقتك للرد على هذا الاستبيان. هذه دراسة علمية حول إعتماد الحوسبة السحابية على مستوى المنظمات. الهدف من هذا البحث هو دراسة العوامل التي قد تؤثرعلى قراراالشركات في تبني الحوسبة السحابية في القطاع الخاص في المملكة العربية السعودية. سيتم استخدام جميع المعلومات المقدمة لأغراض البحث فقط. شكرا جزيلا على المشاركة في هذه الدراسة.

هل تود المشاركة في الاستبانة؟

□ نعم، أوافق و أريد التبرع بالمشاركة

□ لا، غير موافق

الجزء الاول : معلومات عن الشركة

1. خبرة العمل في مجال تقنية المعلومات:

□ 2-5 سنوات

□6-10 سنوات

□ أكثر من 10 سنوات

2. عدد الموظفين في الشركة التي تعمل لديها :

□1-9 موظف

□10-49 موظف

□50-250 موظف

□ اكثر من 250 موظف

3. عمر الشركة (سنة) :

□ أقل من سنة

□ 1-5 سنوات

□6-10 سنوات

□ 11-20 سنوات

□ أكثر من عشرين عاما

4. الإيرادات السنوية لمنظمتكم (دولار أمريكي) :

□ أقل من 1 مليون

□ 1-5 مليون

□6-20 مليون

□ أكثر من عشرين مليون

5. طبيعة عمل الشركة :

□ المواد الكيميائية □ الطاقة /المرافق □ الهندسة

□ الخدمات المالية □ تقنية المعلومات □ التصنيع □ البترول/الغاز

□ بتروكيماويات □ التجزئة □ الاتصالات □ أخرى (أرجو التوضيح .....)

6. نطاق عمل الشركة :

□ عالمي

□ محلي

□ وطني

7. هل الشركة التي تعمل لديها تستخدم الحوسبة السحابية ؟

□ نعم □ لا

8. ماهو نوع الحوسبة السحابية التي تستخدم في شركتكم ؟

□ السحابة العامة

□ السحابة الخاصة

□ السحابة الهجينة

□ لاينطبق

الجزء الثاني: إلى أي مدى تتفق مع العبارات التالية؟

1.نية اعتماد الحوسبة السحابية	أوافق بشدة	أوافق	محايد	غير موافق	غيرموافق بشدة
من المحتمل أن شركتنا سوف تتخذ الخطوات اللأزمة لاعتماد التكنولوجيا السحابية في المستقبل.					
تنوي شركتنا اعتماد الحوسبة السحابية في المستقبل.					
أعتقد ، في المستقبل القريب، لن أتردد في استخدام الخدمات السحابية في شركتنا.					
أشعرأني سوف أوصي بإستخدام تكنولوجيا الحوسبة السحابية لمنظمتي.					

2. جودة الخدمات	أوافق بشدة	أوافق	محايد	غير موافق	غيرموافق بشدة
يجب أن تعمل الخدمات السحابية بشكل جيد لدعم عمليات تقنية المعلومات لدينا بشكل فعال.					
الحوسبة السحابية تتيح لنا الوصول إلى الخدمات في أي وقت (أي 7/24).					
الحوسبة السحابية تتيح لنا الوصول إلى الخدمات من أي مكان.					
وجود الجودة العالية من الخدمات سوف يشجعنا على استخدام الحوسبة السحابية.					
تقديم تعويضات جيدة عن التوقف أوعدم تقديم الخدمة المتوقعة سوف يشجعنا على استخدام الحوسبة السحابية.					
ضمان وجود خدمة النسخ الاحتياطي الجيدة سوف يشجعنا على استخدام التكنولوجيا السحابية.					

3. الأمن	أوافق بشدة	أوافق	محايد	غير موافق	غيرموافق بشدة
أشعر أن الحوسبة السحابية ليست آمنة بما فيه الكفاية لتخزين بيانات شركتنا لديها.					
أشعر أن الطرق التقليدية لتخزين البيانات أكثر أمانا من تكنولوجيا الحوسبة السحابية.					
الأمن عموما، هومسألة حساسة تؤثر على قرارنا في استخدام الخدمات السحابية.					
أشعر أن مخاطر استخدام الخدمات السحابية تفوق محاسنها.					

4. الخصوصية	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
المخاوف المتعلقة بالخصوصية تؤثر على قرارنا في استخدام الخدمات السحابية.					
في السحابة قد تعرض معلوماتي الشخصية إلى أطراف أخرى دون علمي.					
مزود الخدمة السحابية قد يسمح لأطراف آخرى باالوصول إلى معلومات شركتنا في السحابة دون موافقتنا.					
أود استخدام الخدمات السحابية إذا تم ضمان خصوصية معلومات شركتنا.					

5. الثقة	أوافق بشدة	أوافق	محايد	غير موافق	غيرموافق بشدة
اشعربالثقة في تخزين بيانات شركتنا في السحابة.					
أنا على يقين من أنني محمي من المشاكل في السحابة بسبب البنية التكنولوجية الكافية.					
تخزين بيانات شركتنا تحت سيطرة طرف ثالث هو احد مخاوفنا.					
معلومات شركتنا في السحابة يمكن أن تستخدم من قبل طرف ثالث من دون موافقتنا.					

6. الفوائد المرتقبة	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
استخدام الحوسبة السحابية في شركتنا سوف يساعدنا على إنجاز المهام بسرعة أكبر.					
استخدام الحوسبة السحابية في منظمتنا سوف يساعدنا على خفض التكاليف.					
استخدام خدمات الحوسبة السحابية يزيد الإنتاجية لدينا.					
استخدام الحوسبة السحابية يمكن أن يزيد من المرونة في سير العمل لدى شركتنا.					

7. التوافق	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
توافق الحوسبة السحابية مع جوانب العمل سوف يشجعنا على استخدامها.					
أود استخدام الخدمات السحابية إذا كانت متوافقه مع احتياجاتنا.					
استخدام الحوسبة السحابية يناسب أسلوب عملنا.					

الحوسبة السحابية غير متوافقه مع جميع جوانب عملنا.					

8. التجربة	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
من الضروري أن تكون قادر على تجربة الخدمات السحابية بشكل جيد قبل أن تقرر استخدامها.					
قبل اتخاذ قرار إعتماد الخدمات السحابية، من الضروري تجربة هذه الخدمات لفترة كافية لمعرفة كيفية عملها.					
القدرة على استخدام التكنولوجيا السحابيه بشكل تجريبي سوف يشجع شركتنا على استخدامها.					
من الضروري معرفة كيفية التعامل مع خدمات الحوسبة السحابية قبل قرار إعتمادها.					

الجزء الثالث: إلى أي مدى تتفق مع العبارات التالية؟

1. الدعم من الإدارة العليا	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
الدعم من الإدارة العليا ضروري لإعتماد الخدمات السحابية في شركتنا.					
قراراعتماد استخدام الخدمات السحابية في شركتنا يعتمد على الإدارة العليا.					
من الضروري مشاركة الإدارة العليا في صنع القرارت المتعلقة بالحوسبة السحابية.					
من الضروري لفريق الإدارة العليا المشاركة في مراجعة التوصيات المتعلقة بإستخدام الحوسبة السحابية.					

2. الأستعداد التكنولوجي	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
وجود بنية تحتية قوية (على سبيل المثال، عرض النطاق الترددي العالي) سوف يساعدنا على استخدام التكنولوجيا السحابية.					
وجود اتصال إنترنت سريع سوف يشجعنا على اعتماد التكنولوجيا السحابية.					
وجود المهارات التقنية اللازمة سوف تمكننا من استخدام التكنولوجيا السحابية.					
المعرفة التقنية حول تكنولوجيا الحوسبة السحابية لاتزال محدودة لدى شركتنا.					
الحوسبة السحابية تتطلب معرفة تقنية لإستخدامها.					
لانزال نفتقر المهارات التقنية اللأزمة لاستخدام تكنولوجيا السحابة في شركتنا.					

3. التوافق مع اللوائح والقوانين	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
سوف استخدم الخدمات السحابية إذا كانت تتوافق مع اللوائح لدينا.					
سوف استخدم الخدمات السحابية إذا كانت تتوافق مع القواعد الصناعية لدينا.					
القوانين واللوائح التي توجد في الوقت الحاضر ليست كافية لحماية المعلومات المخزنة في السحابة.					
من الضروري أن تتوافق القاونين المستخدمة في الحوسبة السحابية مع قاونين المملكة العربية السعودية.					

4. الموقع الجغرافي	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
سوف استخدم الخدمات السحابية إذا كان موقع مركز البيانات معروفا بالنسبة لي.					
سوف استخدم الخدمات السحابية إذا كان مركز البيانات يقع في المملكة العربية السعودية.					
سوف يتم تخزين بيانات شركتنا في السحابة إذا كان مركز البيانات يقع في المملكة العربية السعودية.					
من المهم لدينا معرفة أين سيتم تخزين بياناتنا من قبل مزود الخدمة السحابية.					

5. الدعم الخارجي	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
من الضروري وجود الدعم التقني الكافي من مزود الخدمة السحابية قبل إعتماد استخدام الحوسبة السحابية.					
من الضروري وجود الدعم التقني الكافي من مزود الخدمة السحابية بعد إعتماد استخدام الحوسبة السحابية.					
وجود الدعم الكافي من مزود الخدمة السحابية سوف يشجعنا على استخدام التكنولوجيا السحابية.					
من الضروري متابعة بائعي البرمجيات الذين يقدمون المشورة الكافية.					
من المهم أن يكون لديك علاقات جيدة مع الأطراف الأخرى (على سبيل المثال، مزودي الخدمات السحابية).					

6. قطاع العمل	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
طبيعة قطاع العمل في شركتنا يؤثر على قرار إعتمادنا للحوسبة السحابية.					
استخدام التكنولجيا السحابية يعتمد على طبيعة العمل في شركتنا.					
التكنولوجيا السحابية هي أكثرملائمة للقطاعات التي تعتمد على تقنية المعلومات بشكل كبير.					

6. التأثر بالعادات والتقاليد	أوافق بشدة	أوافق	محايد	غيرموافق	غيرموافق بشدة
آراء الخبراء تؤثرعلى قرارنا في إعتماد استخدام الخدمات السحابية.					
تكنولوجيا الحوسبة السحابية يمكن أن تؤدي إلى تقليص الإدارات في شركتنا، حيث ان هناك حاجة لخلق فرص عمل للمجتمعات المحلية في المملكة العربية السعودية بدلاً من الاستعانة بمصادر خارجية.					
سوف استخدم الخدمات السحابية إذا كان مزود الخدمة السحابية موجود في المملكة العربية السعودية.					
بشكل عام، نود تجربة التكنولوجيا الجديدة التي يمكنها تسهيل اجراء عملنا.					

شكرا لك على المشاركة في هذه الدراسة.

The structural model in AMOS

Before excluding items that had low values of standardized factor loading